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BRIEFLY TOLD.

THE OIL INDUSTRY OF CALIFORNIA:—The 11th meeting of the Pacific Coast Gas Association (several of the papers read thereat have been published in the JOURNAL) was notable, as have been its predecessors, for the solidity and value of the matter that the authors of the papers put together for the benefit of their fellow members. Our current issue contains the paper by Dr. C. T. Deane, who in offhand manner very interestingly describes "The Oil Industry of California from a Commercial Standpoint;" and we venture to say that not one gas man out of ten, whose homes are not on the Pacific Coast, was prepared to credit the importance of the oil output on the Coast, or had knowledge of the magnitude and stability of such production. It assured the gas makers and sellers of an easy and economical quantity supply of a gas making material, the nearness, cheapness and volume of which puts them measurably independent of the bituminous coal mine owners of the far West, who, to say the least, in times past have not had their dealings stamped too freely with the brand known as liberality. Nor can there be any doubt of the authenticity of Dr. Deane's figures and statements, since his long and active connection with the oil industry of the Coast is of the sort that rightly entitles him to be known as the dean of California's oil traffic. His paper is a most interesting one.

NOTES——

SECRETARY RALPH W. POPE, of the American Institute of Electrical Engineers has just completed and published a "Directory of Membership" in that well-organized and well-maintained Association. The magnitude of the Institute can easily be comprehended from the simple knowledge that its membership rolls carry the names of 2,518 persons, whose residences are as far apart almost as the very poles of the earth. The United States is the abiding place of 2,168 members, and foreign countries hold 344, of whom 87 are residents of England, Ireland and Scotland, and Canada is responsible for 81. On August 1st the Institute had applications from 114 persons for election to membership.

MONROVIA, CAL., is anxious to have somebody put a gas works "in its midst."

A CORRESPONDENT in Lawrence (Mass.) forwards the following: "Some days ago the employees of the Lawrence Gas Company held an outing at Wingate's grove on the Haverhill road. About 100 attended and an enjoyable time was spent. Electric cars conveyed the party to the grove during the forenoon. A full line of sports was carried out. The feature was a baseball game in which the gas department men defeated a team from the electric department by the score of 12 to 3. In the minor sports the gas men won 10 out 12 events. At noon a sumptuous dinner was served and refreshments were served during the entire day. The party returned home about 7 o'clock."

TO-MORROW the citizens of Altoona, Pa., will vote in special election as to whether or not the city shall engage in the operation of a gas plant on municipal account.

MR. SMILEY N. CHAMBERS, of Indianapolis, Ind., is said to have completed the deal whereunder the gas and electric lighting interests of Vincennes, Ind., are hereafter to be operated on joint account.

LIBRARY OF CONGRESS AUG 31 1903

On Saturday last the shareholders of the Granville (N. Y.) Electric Light and Power Company determined to transfer their properties and franchises to a corporation having the title of the Granville Electric and Gas Company.

The Dallas (Tex.) Gas and Fuel Company is now comfortably housed in new, spacious and handsomely equipped business offices, No. 421 Main street.

The Kerr Murray Mfg. Co., of Fort Wayne, Ind., has recently completed the erection of a triple-lift storage holder, resting in brick tank, and up to retaining 425,000 cubic feet of gas, for the Citizens Gas Company, of Findlay, O.

Superintendent Douglas, of the Ann Arbor (Mich.) Gas Light Company, is authority for the statement that the output of gas for the month of July last exceeded that for the corresponding month of 1902 by 25 per cent. The gain for August is in similar ratio, which rather goes to show that the efforts of Mr. Douglas and his associates to give the people of Ann Arbor good gas service are thoroughly appreciated.

The proprietors of the Oskaloosa (Ia.) Gas Company have arranged for and are carrying out a sensible scheme of main enlargement. It is likely that next season considerable reconstruction work will be done on the Oskaloosa plant proper.

A correspondent informs us that Mr. Arthur Phills has been appointed Chairman of the Colombo (Ceylon) Gas and Water Company. The control of the Colombo concern is held in London, England.

Messrs. H. S. Taylor and Ellis H. Orvis have submitted a proposition to the owners which is likely to result in the transfer of the rights and properties of the Bellefonte (Pa.) Gas Company to the first named.

The citizens of Kewanee, Ills., have petitioned the City Council to "take steps for the erection of a gas and electric light plant to be owned and operated in the interests of the city and its citizens."

The ownership of the Equitable Gas Light Company, of San Francisco, is now vested in persons whose business relations are in accord with those who control the fortunes of the San Francisco Gas and Electric Company. Mr. S. H. Tacy has been retained as Secretary.

At the Receiver's sale of the Oxy-Hydrogen Gas Company, of Wilmington, Del., the property was purchased by the Messrs. John and James Dobson, of Philadelphia, who are largely interested in the Wilmington Gas and Electric Company. The price paid was $25,000.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Dr. Birchmore Objects.

New York, Aug. 24, 1903.

To the Editors American Gas Light Journal—Will you be so kind as to read pages 130, 131, in the July 25th issue of the *Gas World*? Yes; do you not feel wiser for the reading? Was ever a more absurd little mouse born from so laborious a mountain? Indeed, the mouse is larger than the mountain; but for fear lest his readers might not see it, the Editor puts it in brackets. "Temperature plays a great part in Dr. B.'s process," says the *Gas World*.

This is information for the multitude. I can assure you that Dr. Birchmore never knew that he had a process. I put in some time in trying to find out how the naphthaline nuisance came to exist, and how it might be avoided, but to the invention of a gas process I never aspired.

To remind anyone that 215° C. is "high" for gas after it has passed its cooling in the hydraulic main and elsewhere is to question the intelligence of his readers, as well as to concede the fact that the Editor does not understand that in the laboratory a "condenser" is only the name of a piece of apparatus.

The surprising part is that a man should presume to abstract a paper and to describe a "process" after a study so superficial that it did not impress him with the entire change in the temperature scheme employed in the gas works and the one used in my experiments.

I admit that the paper is overcrowded with experimental work, and that to follow all the steps I made, apparatus more or less like mine was needed; but I did not imagine anyone would be willing to abstract a paper of that sort and remove everything of importance—in fact, he has saved the picture, as Dolly Madison did the portrait of Washington, by cutting it out of the frame; but, unlike that lady, the *Gas World* left the picture and preserved the frame only.

Yours, W. H. Birchmore.

The Oil Industry of California from a Commercial Standpoint.

[A paper read by Dr. C. T. Deane, at the 11th Annual Meeting, Pacific Coast Gas Association, San Francisco, July 21–23.]

I have been requested to prepare this paper on the business outlook of the oil industry. It does not pretend to any scientific value whatever; it simply looks at the matter from a commercial standpoint. The President and the other officers of the Association assured me, gentlemen, that you would be interested in the question from that point of view. The figures given are absolutely conservative and true. Some of them may seem large to you who are not familiar with the oil situation; but I assure you, from 3 years' active work in this department, as Secretary of the California Petroleum Miners' Association, that the figures are more than conservative. When I say "A million" I could easily say "A million and a-half;" and I carry that through the whole paper. So when the figures seem very large, do not scout them and think they are "boom" figures, for I am anything but "boom."

Oil in commercial quantities has not been discovered north of Fresno county. The principal oil producing districts are in Orange, Ventura, Santa Barbara, Kern and Fresno counties. In and around the city of Los Angeles there are almost 1,000 wells, but the output from them is very small and will aggregate less than a million barrels a year. The great oil producing districts in Kern county are: The Kern river, Sunset and McKittrick districts; in Frenso county, the Coalinga district; Fullerton, in Orange county; Santa Maria, in Santa Barbara county. These districts, excluding Los Angeles, have over 1,000 wells, and if they were pumped to their full capacity they would produce over 18,000,000 barrels of oil per annum. A well to be of commercial value must give at least 50 barrels a day; of course, I mean oil of from 14 to 25 gravity. Higher gravity oils are not used for fuel purposes, but are refined and made more valuable. Consequently a well producing oil of 25 gravity at a less rate than 50 barrels a day would not pay.

A very good well is 100 barrels a day. There are many that produce 200 barrels, and a few that produce 500 barrels, for *a while*.

Most people not acquainted with the oil business imagine that a hole is drilled into the ground until you meet a lake of oil. This is a mistake, as the oil is contained in the sand. The hole is drilled down and cased with 11¾-inch, 9⅝-inch and 7⅝-inch casings, until the sand is reached; then the casing is carried down through the sand and landed on the clay beneath. When you get to the bottom of the sand you strike clay or shale, and there you land your casing. Oil sand can be from 1 foot to hundreds of feet in thickness. After the casing is landed it is perforated by small holes about an inch in diameter all the way up to the top of the sand. The casing is put down into the ground. Then a machine is let down and holes are cut in the four sides as high as the casing goes. The oil flows into the casing through these holes and is pumped out. If there is sufficient gas it will throw the oil out above the casing, and it is then called "a gusher." As the oil is pumped out of the well it is deposited in an earthen reservoir (where the water and sand are separated from it by the action of gravity)[1] and then allowed to flow into tanks, from which it is taken to market by railroad tank cars or pipe line. These cars are 150, 225 and 300 barrels capacity each. The oil as it comes from the wells looks like thick, black molasses.

The life of an oil well depends largely upon the thickness and life of the sand, as we have both dead sand and live sand. The following table will give a very fair approximate result of the amount of oil contained in—

1 acre of land with sand			100	feet	thick	contains 155,400	barrels.
"	"	"	200	"	"	310,800	"
"	"	"	300	"	"	466,200	"
"	"	"	400	"	"	621,600	"

The quantity of oil contained in the sand, according to the best experts, is considered to be about 25 per cent.; 20 per cent. of this ought to be recovered. Twenty acres, therefore, ought to give in the neighborhood of 10,000,000 barrels of oil, if the sand is 300 feet thick. We hear a great deal about oil lands and their value. These lands are divided into proven and wildcat lands—I do not mean to use the word in any sense of dishonesty. By proven land we mean that, if you sink a well, you will certainly get oil. If I have a piece of land and there are wells on all sides, the land is proven; but if there are wells on one side only,

1. I am speaking more particularly of the Kern river district when I say that. It is really the greatest district of California, the second greatest district in the world; and in discussing the question I am referring more particularly to that district all through the paper.

the land is not proven because the territory may stop. Wildcat land is land in which you may perhaps get oil, but it is largely speculative. Of course, in all new districts the land is what is called wildcat until it is proven by the drill

In many of the districts the oil belt will run in a narrow line from half a mile to a mile wide. On each side of this there will be no oil. The Kern river field apparently is an exception to this rule, it being a large, circular body.

In the Kern river district there are over 4,000 acres which are considered absolutely proven; in other words, where you will be sure to get oil if you sink a well. A very conservative estimate of the quantity of oil in those 4,000 acres is 1,000 million barrels. I am not exaggerating; I am under the mark. It has been estimated by many experts that there are 2,000 million barrels. The depth of well varies in different districts. In this field the wells are from 850 to 1,050 feet. As you go west in the field the wells become a little deeper, increasing from 800 and 900 feet to 1,050 feet.

The cost of sinking wells varies largely in the different districts, due somewhat to distance from the railroad and other causes; but wells of 1,000 feet deep can be sunk in the Kern river district, including the casings, for about $3,000 a well; that is, a contract for 10 wells can be made for $30,000. I do not intend to say that you can sink one well for $3,000, but that you can sink a number of wells at the rate of $3,000 apiece. This does not include putting the wells on the pump; that would probably cost $1,000 per well more; $50,000 should equip 10 wells ready for oil delivery.

The gravity of the oil varies also in the different districts. Coalinga and Fullerton districts will be in the neighborhood of 25 to 30 gravity, and is used largely in the making of gas, I understand. The fuel oil of Kern river, Sunset and Midway, and also of the Los Angeles fields, is only about 14 to 16 gravity, and is used largely as fuel and in the making of asphalt.

The consumption of oil has increased by leaps and bounds in a most astonishing degree on the Pacific Coast. The following table is approximately correct:

Consumption in 1900	4,000,000	barrels.
" 1901	8,000,000	"
" 1902	13,000,000	"
" 1903 will be over	20,000,000	"

Six months ago in reading a paper I stated that the consumption would be nearly 20 million barrels; since then we are satisfied from reports from different sources that it will be over 20 millions.

The production of the Kern river district is about 10 million barrels per annum, and at this rate of production will last for 100 years. The balance is produced by the other districts named. The district of Baku, in Russia, which is about half the size of the Kern river district, has produced for the last 15 years in the neighborhood of 75,000,000 barrels per year.

Now, as to the value of these lands. They are selling at the present time at a ridiculously low price; and, strange to say, the people of California are somewhat suspicious of them, even at present prices. I mentioned to a friend on the street a few days ago that I had bought 20 acres of land in the Kern river district at $4,000 an acre, and he looked at me as if I were crazy, while the facts really are that this land, selling at that price, can be made to produce oil for the next 25 years at least, and that at over $1,000,000 profit. The same land is selling in Texas for $50,000 an acre—not as good; and in Baku, Russia, for $100,000 an acre. Proven lands can be bought in the Sunset and Midway districts all the way from $500 to $2,000. In the Kern river district little first-class land can be had for less than $4,000.

The price of oil during the last 4 years has varied largely, due to the simple question of supply and demand. When there were few wells oil was selling as high as 50, 60 and 70 cents a barrel; while, when the wells increased and consumption was not yet prepared to take the oil, it dropped to as low as 10 cents a barrel. At the present time, as consumption is increasing, oil is going up again and is selling readily at the wells in Bakersfield for 30 cents a barrel. I look to see it go to 40 cents before the end of the year. But this is simply a question of supply and demand. I hardly think that production will ever again catch consumption. People are now prepared to take the oil; two years ago they were not prepared. The railroad companies were not prepared to burn oil, except in small quantities. They had no tank cars. The different places in San Francisco that are now burning oil had no preparations made. It took a long time before people were satisfied that there was oil enough. Mr. Scott, of the Iron Works, said to me: "Do you think there is oil enough to last?" This was only two or three years ago. Now everybody went to work and drilled wells, and the consequence was that there was a large production with no consumers. The people who had drilled wells wanted to sell; and they sold for anything they could get. The consequence was that oil went down to 10 cents a barrel.

When you hear people say that the Standard Oil Company fixed the price of oil, they are simply talking about what they do not know. This Company does not own wells. It simply buys as cheap as it can. If there is an over-supply, as there has been up to the present, it buys cheap. When the consumption increases and the demand becomes greater the oil man knows, just as well as the Standard Oil Company does, that it must have oil to fill its contracts. He immediately raises the price of oil, and the Standard or anyone else has to pay, for the owner has the best storehouse in the world; he lets it rest where nature put it, caps his well and waits. A year ago there were hundreds of wells capped in nearly all the districts, for the oil man said: "I will not sell oil for 10 cents." But now you can't find a capped well, for he can sell for 30 cents. And everyone who has the money is drilling new wells to meet the coming consumption.

The railroad charges, including switching and other expenses, are about 40 cents a barrel to bring the oil to San Francisco. That makes the cost here 70 cents; but, to make a profit on it, consumers have to pay 80, and next year probably will have to pay in the neighborhood of $1.

Four barrels of oil equal 1 ton of coal. Coal cannot be laid down in this market for less than $6.50 per ton; so that oil at $1.50 a barrel can compete with coal as to price, not counting many other advantages of oil over the old fuel.

The Standard Company's 8-inch pipe line from Bakersfield to Point Richmond is 278 miles long. It has pumping stations every 20 miles.

This Company has made investments of over $15,000,000 in California up to date, and the investments are all in permanent improvements such as refineries, pipe lines, tankage, etc.; and it certainly speaks well for the future of the oil industry when a great corporation like this is willing to invest such a large sum.

This oil has to be pumped from one station to another about 20 miles apart, and has to be heated to over 150° F. so as to make it flow. I have no official knowledge of the quantity the Standard Oil Company expects to carry through its pipe line; but from some studies that I have made on the subject I should say that if it got 5,000 barrels a day it will be doing well. Since this was written I understand (not officially) from some people who think they know that it is flowing at a much greater rate. I have my doubts; but only time can tell. The large refinery at Richmond will absorb this quantity; so this will not relieve the railroads appreciably nor compel them to lower freight rates.

The transmission of oil in pipe lines is one which has never been treated in the published works of scientists and engineers, although it has been extensively practiced during almost the whole history of the industry. The practical methods and governing scientific rules of the work have been thoroughly worked out, but have never been made public. While the practical principles developed in handling the light oils of the Allegheny oil fields, varying from 40° to 50° B., and of the Ohio-Indiana fields varying from 34° to 38° B., have been sufficient to enable an engineer to calculate accurately just what can be done with such oils, yet the oils of California, being of an entirely different character, compel an entirely new and different treatment of the subject. The oil of Baku and the oils of Pennsylvania and Ohio have a paraffine base, while our California oil has an asphalt base. Aside from a few samples, we have not yet discovered in California any oil with a paraffine base.

At present the oil to be transported comes from the Kern river oil field and varies from near 12° B. to about 17° B., averaging about 15½° B. in gravity at 60° F.

In transmitting it by pipe line there are several expedients to facilitate the service which may be suggested:

1. To pump the oil at normal temperatures.
2. To mix distillates or lighter oils with the crude oil.
3. To heat the oil to the highest practicable temperature.
4. To heat the pipe line at points intermediate between the pumping stations.
5. To mix water with the oil.

This paper is not the place to go into a scientific treatise on the subject of pipe lines; but as there has been a good deal of discussion of what the railroads would be compelled to do after the Standard pipe line was really working, it might be well to see how many tank cars it would take to carry the same amount of oil, assuming that the delivery will be 5,000 barrels daily. With trains able to haul over 10,000 barrels between terminals it is apparent that the railroads can handle immense quantities of oil.

If the railroads should organize a 5-day trip they could deliver 5,000 barrels a day with—

152	cars	of	150	barrels	capacity.
101	"	"	225	"	"
76	"	"	300	"	"

The fact is that they are delivering 25,000 barrels per day now, The railroads have about 1,600 tank cars, 800 of which they are using for their own tanks.

There are in the State at the present time in the neighborhood of 40 refineries. These refineries make asphalt, distillates and lubricating oils, and there is a very strong movement on foot to substitute asphalt for bituminous rock in the making of our streets, as being far more durable and not any more expensive.

There is a great difference of opinion as to the cost of pumping oil. In other words, after you have bought your land, sunk your wells, put up all your machinery, tanks, etc., what does it cost you to put the oil on top of the ground? Of course, in this cost you have to include interest on the money invested, running expenses, superintendence, office, etc. We can see why there should be such a difference of opinion on this subject, as salaries and office expenses can be run up to any figure desired; but in a well managed corporation, where salaries are no higher than they would be in an ordinary business, if I put it at 4 cents a barrel I am satisfied that I am making it as high as it legitimately should be. Some of the best managed companies do it at a much less figure, and these are the companies which pay dividends. As to the saving of oil over coal, we have been using it sufficiently long to get a very thorough knowledge, and when we say that we save 50 per cent. we are rather below than above the mark.

The use of oil on steamships is increasing very rapidly, and there are now over 200 marine boilers in use out of this port. The saving there is much larger than on shore, as it includes coaling, space for coal (which is utilized for freight), weight (which is one-third less), speed (which is increased) more than half the labor in firerooms, and the absence of dirt in the form of ashes, etc. I understand that Mr. Spreckels is saving in the neighborhood of $200 a day on the steamer "Mariposa" which runs from this port to Tahiti, and that the speed has been increased one knot an hour. The reason of the increase in speed on a ship burning oil over that on a ship burning coal is the fact (which you gas men probably understand better than I do) that the furnace doors do not have to be opened, letting the cold draft in. The doors are closed all the time, and it is easier to keep the steam up to the desired point.

When the railroads are prepared to use oil exclusively—in other words, when they have their tanks completed all along their road, which will take some little time yet, perhaps by the end of this year—they will be using over 10,000 barrels per year.

There is gradually developing a large use for oil in the sprinkling of roads. An oiled road is so much better—more durable, cleaner and less costly—that the Boards of Supervisors throughout the State are gradually learning; and even in San Francisco they are commencing to oil the roads leading out of the city. It takes about 150 barrels of oil to oil 1 mile of road (the oil has to be heated to get the best results), and it costs less than $200 per mile. I think we can look forward to using in the neighborhood of a million barrels of oil the coming year for this purpose.

The production of gas in California at the present time is, I understand, approximately 12,000,000 feet a day. (I understand from some of the gentlemen present that this is rather a conservative estimate.) As gas is now being made almost exclusively with oil, this will take over a million barrels.

It is not at all a wild estimate to say that in less than 5 years we will be consuming over 50,000,000 barrels of oil per annum. All marine boilers leaving this port will be compelled in self-defense to use it. The saving on a round trip to Manila and return by one of the transports using oil instead or coal would be over $20,000. It is pretty well conceded that within a short time the boats of the revenue service and the smaller national vessels, such as gunboats, torpedo boats, etc., will use oil, as very thorough tests being made at Washington have been very satisfactory, and California oil has given better results than that produced in Texas.

There have been several millions of dollars kept in the State by the substitution of oil for coal, which money has been invested here and is one of the great reasons of the advance in real estate. There have been paid in dividends from oil companies nearly $5,000,000 to their stockholders.

And now, gentlemen, I have given you as rapidly as I could the facts of the oil situation from a commercial point of view. I will not presume to deduce from them any conclusions to so intelligent an audience, as you are as well able to do that as I am; but permit me very modestly to remark that the discovery of oil fuel in California is the most important event since the discovery of gold. We had gold, we had grain, we had fruit, and above all we had climate; but to become a manufacturing State we lacked fuel. And as this is God's country, God has been very good to us. He has showered upon us all things—we have nothing else to ask. It remains only now for us, His creatures, to appreciate at their full value all these good things by being honest, upright, strenuous business men.

The Cheapening of Coal.

By Mr. F. E. Saward, in *Iron Age*.

Anthracite Steam Coal.—One of the peculiar features of the coal industry this year is that there is a very large production of anthracite. While this description of coal is composed in the main of sizes used for domestic fuel, yet in the preparation thereof there is an important proportion of the minor sizes made which enter into use for steam raising in all the varied industries, particularly in the Middle and Eastern States. It is, therefore, of great interest in this regard to note the proportions of the various sizes of anthracite coal. The best information on this point is found in the last annual report of the Girard Estate, which gives the proportion as follows: Chestnut and larger, 49.76 per cent.; pea, 15.47 per cent.; buckwheat, 23.49 per cent.; rice, barley, etc., 11.28 per cent. Some mines may do a little better on the domestic sizes, but this proportion, with a large output, means a lot of steam coal, much to the advantage of the consumer. The fact that the production of the junior sizes has now reached a monthly total of about 2,000,000 tons seems to be generally disregarded. This tonnage has to be disposed of, and, of course, will be.

The anthracite steam sizes are being offered very freely throughout New England and in every manufacturing center reached by the hard coal roads. Eastern consumers who have never yet used pea, buck or rice are now considering changing the grates in a portion of their plants to burn these sizes. The extent of the anthracite steam tonnage must have an effect on the market for bituminous steam coals, and it will probably be found that the amount of anthracite available, and the prices at which the coal is offered, will check any panicky advance in bituminous that might follow the car shortage expected during the fall and winter. The steam sizes are hard to market, and it has been deemed necessary by producers to reduce prices in an effort to induce buying. The Reading Company cut their contract figures to 50 cents below the circular for all pea and buck delivered during August on line and city business, making them $1.75 and $1.25 respectively at the mines. The Pennsylvania followed this lead, but these reductions scarcely bring the prices down to the level at which these sizes are being sold by the individual owners. Dollar buck is freely mentioned; and freshly mined coal is meant, not the washery variety.

The Philadelphia textile strike shows signs of disintegrating, and the resumption of 300 odd plants now idle will use up some of the surplus buck and pea in that vicinity. The movement of cheaper coals into use in steam plants is oftentimes retarded by a general unwillingness on the part of firemen to experiment with a new coal. They are loath to make a change and will advise against it. In one instance the engineer of a large plant contended with the dealer that his product was dearer in the end, stating it would require an additional fireman. The dealer succeeded in getting the firm to make a test, keeping a careful account of results, and in the end the engineer acknowledged that he was in error and recommended using the coal urged. As to the relative values of different grades of coal, there is room for difference of opinion, but it seems that too often engineers and firemen are content to stay by that to which they are accustomed, and are unwilling to consider a new article.

Bituminous or Soft Coal.—Soft coal prices have shown a decided downward movement within the past month or 6 weeks, and there is considerable discussion as to what is needed to put the seaboard bituminous trade on a better basis from the producers' standpoint. While some point out the growing concentration of interests as a means that will eventually adjust matters, by putting the ownership in few hands, it is realized by others of less patient character that something more radical should be done. The time seems to be ripe for some one of aggressive policy to take the lead in outlining a plan of action for the bituminous producers, as the present season has been one of the most unsatisfactory on record. While prices are generally fair, there is much rag-

gedness to the market, and this is particularly disappointing to the producing companies in view of the admittedly good business conditions in other lines. The point is that the trade undertook to accomplish too much, without having the requisite cohesion to achieve its purpose. Another year either a less ambitious policy as to prices must be marked out, or means taken to hold all interests together throughout the year. It is not necessary that a price should be fixed—that is looked upon as impracticable—but a series of prices might be fixed which would have regard for the different varieties of coal, and the demand for them, and take into consideration the condition of demand and supply at various seasons of the year. This would be of most decided advantage to consumers, for, as it has been this year, the party who contracted early is not in so favorable a position as the concern that took the risk of the open market in regard to its fuel

In the Western Pennsylvania soft coal districts there is already the cry of shortened transportation facilities, but this is for the reason, perhaps, that the Northwest is taking more coal this year, as the railroads there are busy, and expect to continue so, in the handling of the crops; they need coal. Coal tonnage is being put out to the full limit of the car supply, which is much behind the requirements, and which shortage is annoying to the mine managers and company officials. While the tonnage already sent forward is considerably ahead of the amount at the same date last year, it is, nevertheless, short of what was hoped would be the case, and promises a shortage at the upper docks unless navigation shall remain open until late in December for the Lake Michigan ports.

Earnings of the Pittsburg and the Monongahela coal companies are reported to be much higher than at the same time last year. The statement issued by the Pittsburg Coal Company for the first six months of the current year ought to inspire some confidence in the condition of business in this country. The increase of net earnings for June this year is nearly 50 per cent., as compared with the net earnings for June of last year. The net earnings for the first six months of the year are more than double those of the first six months of last year. The net earnings of the first six months of the year will pay interest on the bonds and the preferred dividend for the entire year.

There seems to be no end to the operations projected in various sections of the country looking to the furnishing of a supply of coke. The foremost in this direction is the enterprise known as the National Coal and Coke Company. In this company a number of the officials of the old Frick Company are interested, and they will pick up the scattered threads of the former company as expeditiously as possible, and serve the trade in the same manner as under the old corporation. It is intended to expand the trade by making a special effort to supply domestic and other consumers with crushed coke, as well as to undertake contracts for blast furnaces, foundries and other manufacturing consumers. It is also expected that a considerable trade can be developed for the coke supply of locomotives in use for shunting cars in cities, in which, because of the continued uproar and protest about the smoke nuisance, legislation is being agitated to forbid the use of raw soft coal. Other companies are looking into the possibilities of this expansion of the demand for coke, and a careful study of the growth of coke for use as a domestic fuel, especially for house heating, furnaces and boilers, has been made, which is said to indicate a growth of the use of coke in these directions that justifies greater energy to push it than has been done in the past. Hitherto this trade has been a precarious and uncultivated growth; now it is purposed to nurture it with judicious and well directed energy.

Coke business is on the mend for the better grades, but good furnace cokes from the West Virginia smokeless regions can be bought either for present or future shipments at $2, at oven, while high sulphur coke can be bought at $1.65, at oven. The tendency of foundry coke is downward, and it is stated that foundrymen can secure contracts running six months at $3, at oven, though $3.50 and $3.75 are the quotations that are more commonly heard.

Consuls and Commerce.

In a fairly well repressed roar over the relations of "Consuls and Commerce," as these affect England and other countries, *Engineering* declares:

For a good many years past we have had a considerable amount of criticism of the British consular system, some of which was, no doubt, one-sided and unfair, but which, on the whole, seemed to show that our service, in some respects, compared unfavorably with others, and especially with that of the United States. The result of the criticism was the appointment by Lord Lansdowne of a committee to inquire into the constitution of the service and to report as to improvements which might be made in the conditions of entrance and in the amounts of the salaries. They were specially asked to consider whether means could be adopted to give consular officers opportunities of increasing their practical knowledge of commercial matters, and to bring them more into personal contact with the commercial community. The committee have issued their report, the chief points of which may be briefly noticed.

Much of the evidence given to the committee indicates that the members of the Consular Service are doing good work, and that, considering the present conditions of their career, they show a creditable spirit of zeal and industry. Amongst other duties which make great demands upon their time are the engagement and discharge of seamen, the administration of the remainder of the Merchant Shipping Act, and generally attention to the interests of British subjects who require their services. Moreover, the social position which the consular representatives of this country are called upon to maintain must not be forgotten. Regardiug the suggestion which has often been made, that the consuls should exert themselves more to advance the interests of British merchants and manufacturers, the committee remark that evidence has been submitted to them tending to show that the most successful British traders have no desire to invoke the assistance of our consuls, and that they consider themselves able to obtain much more useful information for their business than the best consuls can supply. There remains, nevertheless, they say, a certain demand for the commercial intelligence which consuls are in a position to afford, and their trade reports are undoubtedly of interest and value to the commercial community. Considering the competition to which British trade has been subjected to during the past 30 years, and the probability of the increase of that competition in the future, the committee consider that the interests of British trade abroad would be advanced if consuls had a business training which would qualify them to forward and safeguard, and at the same time incline them to sympathize with, the interests of British merchants. Consular officers must, indeed, have the qualifications necessary to enable them to discharge efficiently their other consular duties; but the committee believe the latter qualifications to be in no way incompatible with the former. On the contrary, they think that a business training of a few years will be of material assistance to those officers in performing their duties generally.

At the present time the British consular services in the Levant, Persia, Siam, China and Japan are recruited by means of open competition under the Civil Service Commissioners, the limit of age being from 18 to 24. The general consular service, that is, for all countries other than those named, is recruited solely by nominations of the Secretary of State for Foreign Affairs, the ages of those appointed being anything from 25 to 50, both years inclusive; officers appointed in this way are obliged to show that they have a certain fitness for their appointments. The committee are of opinion that the general consular service as it at present exists offers no attraction to capable young men. It is not a properly constituted or graded public service, and offers no definite prospect of promotion to those who enter it, for men who are new to the service may be given appointments over the heads of others who have been there for years before them. Therefore the committee strongly recommend that the present system of nomination and age limits for the general consular service should be abolished, that admission into that service should be by limited competition, and that the age of admission should be from 22 to 27; these limits will enable candidates to compete who have had both a university and a commercial training. At the same time, they think that power should be reserved to the Secretary of State to appoint any person, regardless of age limit, to one of the higher posts for which special qualifications may be required; but such appointments should be rare, as in the diplomatic service, and should only be made in exceptional circumstances, and when they are clearly in the public interest, so as to avoid lessening the attractions of the service, and blocking the promotion of deserving officers.

The committee recognize the advantage of having in the service men who have a practical knowledge of business matters, and they suggest that great advantage would result if young men trained in commercial houses could be induced to enter the consular service. Such men would speedily get into touch, and would be in sympathy, with the commercial community of the place at which they were appointed to reside, and would be capable of appreciating the difficulties with which our merchants abroad have to contend. They would also be qualified to furnish the kind of information likely to be of general interest and value to the commercial community at home, and without going so far as to propose that at first candidature for the consular service should be confined to such men, the committee are of opinion that a proportion of the nominations for the suggested limited competition should be given to young men who have received a good commercial training. The applicants

should be required to satisfy the Secretary of State, before they receive nominations, that they have had a liberal education; that they have had a commercial training of 4 or 5 years, and that they are in other respects, from their previous history, likely to be qualified and suitable for the consular service. The subjects of examination are such as can be studied in good secondary schools, combined with those of a special nature which can be taken in a commercial or technical college. We would imagine that, as a rule, these could be taken in the evenings during the period the young men were in commercial positions. The commencing salary at 24 is proposed to be £300, rising to consuls at £1,000, and consul-generals at £1,200 a year, figures which should, in these competitive days, be sufficient to attract fairly good men. The committee have been led to the conclusion that the system of maintaining unpaid consuls, even in many large cities, is a good one. There are numerous places of great commercial importance where British residents are very few, and British commercial interests inconsiderable. In these posts unpaid consuls—in some cases foreigners—are doing most useful service; and being almost always business men, furnish excellent reports on commercial subjects.

Should the proposals of the committee be adopted by the Secretary for Foreign Affairs, they should lead to a great improvement in the consular service, and in the reports issued by it. We would suggest that, even with the existing arrangements, the Foreign Office might issue its reports more promptly. In this respect it is far behind the American Consular Department, which issues elaborate reports on all kinds of subjects, which are of great use to commercial men, and that with a promptitude which is worthy of imitation.

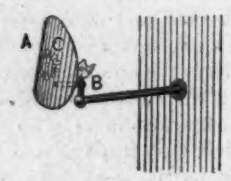

Fig. 1.

Fig. 2.

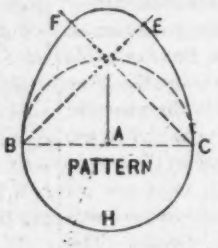

Fig. 3.

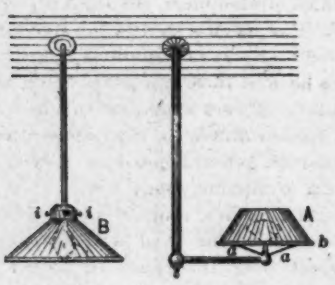

Fig. 4.

Fig. 5.

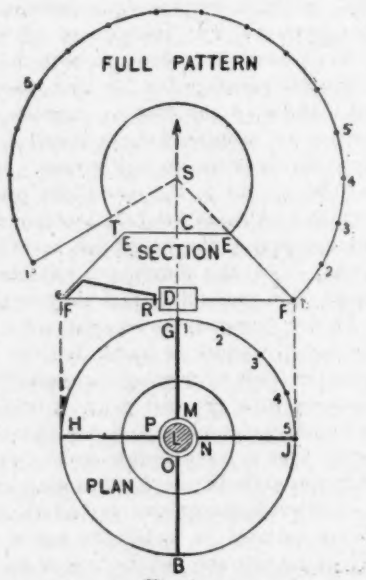

Fig. 6.

Patterns for Gas and Electric Shades.

Patterns for Gas and Electric Shades.[1]

When a gas light is to remain burning through the night and it is desired to keep the light from a certain part of the room, a small gas shade is used, as shown by *A* in Fig. 1, which is slipped over the burner at *B*. A few perforations may be cut into the shade *A* to throw out a little light if desired. The construction of this shade is shown in Fig. 2. *A* represents the burner, around which the brace *a a* is fitted and soldered to the shade *B*, as shown. The brace *a a* is made from a tin strip 1 inch wide with a ¼-inch edge turned over on each side, leaving the finished width ½ inch. The edge is then placed toward the outside and the brace bent in the position shown, so that it can be slipped on and off the burner at pleasure.

The pattern for the shade is obtained as shown in Fig. 3. Take the stretchout of *a b* in Fig. 2 and place it on the horizontal line *B C* in Fig. 3. Bisect *B C* and obtain *A*. Using *A* as center with *A B* as radius, describe the circle *B D C H*. From *A* erect the perpendicular, intersecting the circle at *D*. From *C* and *B* draw lines through *D* indefinitely, as *C F* and *B E*. With *C* and *B* as centers and with radii equal to *C B*, draw the arcs *B F* and *C E*. With radius equal to *D F* and *D* as center, describe the arc *F E*. Then will *F B H C E* be the pattern shape, in the center of which perforations may be cut out, as shown at *C* in Fig. 1.

In Fig. 4, *A* shows a gas shade fastened to the burner by means of the wire braces *a a*, which are soldered to the bottom of the shade at *b*. *B* in the same figure shows an electric shade with a wire edge at the bottom and fastened to the electric light fixture by means of small screws at *i i*. The method of constructing the electric shade is shown in Fig. 5, in which *A* is a cross section through the shade with a wired edge at the bottom at *a a*. At the top of the shade a swedge is formed, as shown at *b b*, into which the small screws are turned to hold the shade in position. This swedge can be turned in the large turning machine.

Fig. 6 shows a section of the construction of a gas shade, together with its plan and pattern. The method of obtaining the pattern is also applicable to the shade shown in Fig. 5. In F.g. 6 draw the center line *A B*, upon which place the height of the shade, as *C D*. Through the points *C* and *D* draw the horizontal lines *E E* and *F F*, equal respectively to the top and bottom diameters. Below the section draw the plan *G H B J*, struck from the center *L*. Draw the two diameters *G B* and *H J*. Divide *G J* into equal spaces, as shown, from 1 to 5. Extend the line *F E* in section until it meets the center line at *S*. Using *S* as center, with radii equal to *S E* and *S F*, draw the arcs *E T* and *F* 1°. On the outer arc place four times the stretchout of *G J* in plan, as shown, from 1 to 5 to 1 to 5 to 1°. From 1° draw a line to *S*, intersecting the inner arc at *T*. Then *T* 1° *F E* is the pattern for the conical shade, to which laps must be allowed for wiring and seaming. After the shade is finished with a wired edge, at *F* in section, make a collar, *M N O P*, ½ inch wide, with a hem edge on both sides, and solder it to fit over the burner *L* in plan. Use tinned wire about ¼-inch thick and bend it to a shape shown by the heavy line *F R* in section. Four of these wires will be required, as shown by the heavy lines in plan. Solder these wires to the collar *D* in section, at *R*, and to the lower edge of the shade at *F*. These shades are usually made from bright tin painted green on the outside and polished or painted white on the inside.

1. *The Metal Worker.*

The Future of the Steam Engine.[1]

The 5 years' extension of his patent of April 23, 1884, granted to the Hon. C. A. Parsons has now expired, though in view of the originality of his invention and its probable commercial importance in the future, few, we think, would maintain that the patentee has been able to reap an adequate reward for knowledge and skill, notwithstanding the extended life of his patent. Fortunately, in this instance the inventor had capital at his command, as a poorer man would probably have ruined himself in the struggle to overcome the—at that time—well-founded prejudices of engineers against any departure from the well-tried type of reciprocating steam engine.

Lord Kelvin has described the invention of the Parsons turbine as the

1. *Engineering*, England.

greatest advance made in steam engine practice since the time of James Watt; and it is of interest to note that just as Watt was fully abreast of the science of heat, as understood in his day, so the creator of the compound steam turbine was also well equipped with theoretical knowledge, having been twelfth wrangler in 1796, and in addition to this, like James Watt again, was also a very capable mechanic. Indeed, the advance made required constructive ability of a high order, combined with a competent knowledge of the properties of steam and the theory of the ordinary water turbine. The multiple expansion reciprocating engine, the other great discovery in steam engine practice made last century, belongs, on the other hand, to a different class of improvement, the invention being in the nature of a lucky accident, since the inventor introduced the system solely to meet certain mechanical considerations, and without any expectation of economizing steam. It was the fact that for many years no rational explanation of the economy of the compound engine was possible, which made so many makers of high class Corliss engines slow to introduce the principle into their own practice. This explanation was finally arrived at by the detailed study of the indicator diagram, rendered possible by Regnault's experiments. This study showed that at the point of cut-off the steam present in the cylinder was often not more than 50 per cent. of the total feed. When the significance of this fact was grasped, high class engine builders commenced to compound their engines, with the result that the steam consumption of these was reduced from over 18 pounds per indicated horse power per hour to well under 12 pounds. Engineers are sometimes, in regarding the magnitude of their own achievements, tempted to ignore the help they have received from the physicist; but though it is quite true that the results of the indicator analysis above mentioned are now applied daily by many quite incapable of making it themselves, their debt to Regnault remains, just as that of the draughtsman who uses a table of circle areas does to the dead and gone mathematicians who first succeeded in approximating to the value of π.

As matters stand, the master feature of the Parsons turbine is now open to the whole British manufacturing world, and incidentally is likely to afford it an excellent object lesson in the practical value of some acquaintance with elementary thermodynamics. Many excellent engine builders, having by a system of trial and error succeeded in building capital steam engines of the ordinary type, will now find their accumulated experience valueless to them if they enter the new field; and lacking the guidance of the theta phi diagram, or its equivalent, may find themselves like mariners afloat on a strange sea without sextant or compass. That they must sooner or later adventure the voyage seems very probable, unless they content themselves with building the smaller class of prime mover for which the turbine seems less well adapted than for larger units. The makers of large reciprocating engines will, it is true, have another course open to them, in that they can take up the manufacture of internal combustion engines, which promise to be in the future the principal competitor of the steam turbine in the economical production of power on a large scale. The change, however, from the manufacture of high class steam engines to the building of large gas engines will also involve the "scrapping" of much valuable experience.

Nevertheless, where an adequate fall of water is unavailable the large power stations of the future will, it would seem, be almost certainly equipped with either steam turbines or gas engines. The latter have, of course, certain advantages from a thermodynamic point of view, but require a large staff to look after them. It is true that of late years some remarkable results have been obtained with the ordinary type of steam engine operated with superheated steam, but these are in no way better than similar results obtained with large turbines, as may be shown by the fact that Messrs. Brown, Boveri & Co., in the case of a 10,000-horse power turbine, now on order for Frankfort, have guaranteed a steam consumption of 15.4 pounds per kilowatt hour, which is claimed to be equivalent to 8.8 pounds per indicated horse power hour. One objection may properly be taken to many recent statements as to steam consumption, which are often impossible to compare one with the other with absolute fairness, since this steam consumption is reckoned at boiler pressure instead of being reduced to "from and at 212°." It is thus not easy to make a really accurate comparison between engines using steam under different conditions. The engine taking steam at the higher pressure gains an advantage over and above that legitimately due to its greater temperature range. As matters stand, however, the pressures used in turbine plants are practically the same as in the case of modern reciprocating engines, being fixed by the type of boiler used. Dr. de Laval, it is true, has driven his turbines with steam generated at pressures of 1,600 pounds per square inch or more—a feat which it would not be easy to parallel with a reciprocating steam engine; though it must be borne in mind that somewhat similar pressures are reached in the Diesel oil engine, which is of the reciprocating type.

Whilst, however, the reciprocating engine can apparently compete with the turbine in the matter of steam economy, in every other respect the advantage seems to rest with the newer motor. The Turbinia gave one a striking object lesson in this regard. With an ordinary type of torpedo boat destroyer running at high speed, the whole floor of the engine soon becomes flooded with oil; which certainly constitutes an excellent example of the truth of Palmerston's definition of dirt as matter in the wrong place. With turbine machinery there is no difficulty in keeping the engine room clean; and the staff there has certainly its labors much reduced.

In spite of the 8,000-horse power on board the "Queen," there is nothing whatever to see in the engine room. The lubrication is automatic, and the greaser, of such importance on board sister vessels of the same service, has little or nothing to do. Even in the less strenuous conditions of central station practice, the saving in oil as compared with a reciprocating engine is equivalent to a saving of at least 1 pound of steam per indicated horse power hour, whilst at the same time the staff may be reduced by a half, if not more. With these advantages it is certain that large engine making firms will, as suggested above, be compelled in self-defence to take up the manufacture of this class of prime mover. Already several firms have done so. In this issue we give an account of two turbine steamers which are being built by Messrs. Vickers Sons & Maxim, and by Messrs. William Denny & Brothers, for the Midland Railway. The British Westinghouse Company is preparing to build large turbines for electric stations, and also Messrs. Wilans & Robinson, Limited, while two firms at least on the northeast coast are entering into the manufacture of steam turbines. By the aid of these firms and others it is probable that a number of valuable improvements of a minor character may be effected.

An interesting modification of the Parsons turbine is now being put on the market by the General Electric Company of America. In the Parsons turbine the pressure varies continuously as the steam passes through successive series of blades. The type may therefore be considered to be a compound "pressure" turbine. It is, however, quite possible to apply the compounding principle to an impulse turbine of the Girard type, or, as we are speaking of steam, we should perhaps say of the de Laval type. This idea seems to have originated with Mr. Ferranti, whose patent is numbered No. 2,565, of 1895. The same idea, probably quite independently, was taken up by Mr. C. G. Curtis, of New York, whose earliest English patent is dated September 1, 1896. There is, however, a long road to be travelled before a good patentable idea is satisfactorily converted into solid metal, and so far as we are aware, Mr. Ferranti never made the attempt, being probably too much occupied with ether matters. Mr. Curtis was, however, more persistent, and succeeded in interesting the powerful General Electric Company, of Schenectady, who, after much experimenting, are now putting on the market compound impulse steam turbines of very large size, which it is claimed show a very high efficiency. One advantage of this type lies in the fact that it is unnecessary to admit steam over the whole circumference of the turbine. In fact, the Curtis steam turbines can be constructed as "partial admission" turbines. The diameter of the rotor may therefore be comparatively large even for units of no great size, and the speed of rotation may be correspondingly reduced; with a pressure turbine, on the other hand, the size of the rotor is somewhat rigidly connected with the power to be exerted, as the steam must be admitted over the whole circumference of the wheel.

The governing of an impulse turbine is similarly a more simple matter than the corresponding problem in the case of a pressure turbine. It is merely necessary to reduce the arc of the rotor through which steam is admitted. In the original de Laval type several nozzles played on the same wheel, and as the load fell these were shut off one by one, reducing the expenditure of steam and the power delivered in a corresponding degree. Quite a similar arrangement in principle, though differently worked out, has been adopted in the case of the Curtis turbine. The largest size for which designs have yet been got out is rated at 5,000 kilowatts. The speed in this case is 514 turns per minute, and it is claimed that the steam consumption on full load will not exceed 19¾ pounds of steam per kilowatt hour. The axis of these turbines is vertical. The load on the footstep is simply that due to the weight of the rotor, and this footstep is lubricated by oil supplied under a pressure of 250 pounds per square inch. In order to prevent damage in case of a failure of the oil supply, provision is made for automatically shutting off the steam should the pressure in the oil pipe fall below a certain limit.

It will be seen that the efficiency reached by this type is not yet as high as has been attained by Messrs. Brown, Boveri & Co., with large compound pressure turbines of the Parsons type. But the construction of compound impulse turbines is still in its infancy, and there is no reason to suppose that with greater experience better results will not be obtained; though even as matters stand, the steam consumption guaranteed by the General Electric Company closely approaches the best figures given by engines of the ordinary type, being equivalent to little over 11 pounds per indicated horse power; and, taking in account the saving possible in lubrication and labor, these turbines probably make at least as good a showing from the commercial standpoint as that of the very best reciprocating engines, though we note that Mr. Charles T. Porter, to whom the practice of mechanical engineering is already so deeply indebted, is prepared to guarantee a consumption of under 9 pounds of steam per indicated horse power hour for engines built to his designs. His system comprises the use of steam at a pressure of 300 pounds per square inch, superheated by 200° F. or more. The designed speed is 600 revolutions per minute for a piston speed of 2,000 feet per minute. It should also be noted that Messrs. Easton & Co., who are the British licensees for the Schmidt superheater, are also prepared to guarantee an exceptionally small steam consumption for their engines.

Coming back to the Curtis steam turbine, it is very improbable that the highest economy possible with these has yet been reached. In some respects the type has a mechanical advantage over the Parsons turbine, in that the clearance can be somewhat larger; but it must be admitted that hitherto no difficulty has yet arisen in the pressure turbines from the smallness of the clearance allowed.

Some Tests of Recording Wattmeters.

By Ingwald A. Rosok, in *Elec. World.*

In some tests of several makes of recording wattmeters, the connections and methods employed were in all cases as follows: The ammeter or series coil of the portable wattmeter was placed in series with the meter under test, care being taken in case of the portable wattmeter to insert it on the service side of the meter. The voltmeter or shunt coil of the portable wattmeter, or both in case both a voltmeter and a portable wattmeter were used, were connected in multiple with the shunt coil of the meter. Runs were then taken beginning with the smallest loads at which the meter would move and increasing them with each successive run until 50 per cent. overloads were reached. The results were plotted on co-ordinate paper laying off the load as found by the portable wattmeter or ammeter and voltmeter as abscissæ and the percentage of load registered by the formula,

$$\text{Watts} = \frac{3{,}600 \times \text{constant of meter} \times \text{rev. of disk}}{\text{Seconds of run}}$$

as ordinates. The resulting curves then showed the accuracy of the meter under all loads and conditions.

When leading or lagging currents were used an ammeter, a voltmeter and a portable wattmeter were connected in the circuit, since it in all cases was desirable to know the power factor. This was obtained by dividing the reading of the portable wattmeter by the product of the voltmeter and ammeter readings, which gives the power factor in decimals.

The running efficiencies of the meters were determined by finding the I^2R losses in the field and armature, the sum of which gives the total watts lost. The total number of watts passing through a meter minus the watts lost in the meter divided by the total watts gives the running efficiency, or

$$\text{Running efficiency} = \frac{\text{Total watts} - \text{watts lost in meter}}{\text{Total watts}}$$

It will thus be readily seen that in order to have high efficiency a meter must have a large impedance in its shunt coils and a small resistance in its series coils. In most of the meters tested the running efficiencies at loads of .05 of their rated capacities were found to be about 95 per cent., at .1 about 97 per cent., at .2 nearly 99 per cent., and at full load about 99.5 per cent. On overloads the running efficiencies were generally smaller than at full load.

The all-day efficiencies were obtained by finding the number of watt hours lost in 24 hours when the meter was carrying a full load for different periods per day. The watt hours lost in the meter subtracted from the total watt hours passed through the meter divided by the same gives the all-day efficiency, or

$$\text{All-day efficiency} = \frac{\text{Total watt hours} - \text{watt hours lost}}{\text{Total watt hours}}$$

Curves were then plotted with watt hours as abscissæ and percentages of loads registered as ordinates. These curves rise more slowly than the running efficiency curves, and considering 5 hours an average period of full load, the efficiencies were found to vary from 98 to 99 per cent., an average being about 98.5 per cent. This is about 1 per cent. less than the average full load efficiencies, the difference being due to the large number of watt hours lost in the shunt coils of the meters at no load.

The running performances of the meters under different non-inductive loads varying from zero to 50 per cent. overload were found as previously explained. Most of the meters tested were new from the factories, and these performances were, therefore, in all cases found to be very good.

Variations in voltages were found to have considerable effect on the direct current meters with compensating coils. It was thus found that one 15-ampere meter tested ran 10 per cent. too fast on 1-ampere loads when the voltage was 10 volts above normal, and 10 per cent. too slow when the voltage was 10 volts below normal pressure. On meters without compensating coils changes in voltage of 10 per cent. or less had no noticeable effect. Of the induction meters tested only one was much affected, the performance of the others being but very little changed. The meters affected ran in all cases too fast on high and too slow on low voltages.

Different frequencies affected all of the induction meters noticeably. It was thus found that several of the meters tested which ran correctly on 60 cycles, ran from 5 to 10 per cent. slower when tested on 40 cycles and from 2 to 6 per cent. too fast when 80 cycles were used. The ampere-hour meters were very little affected and the meters with commutators were not affected at all by changes in frequencies.

Inductive loads were found to affect meters with commutators considerably, lagging currents making them run too fast and leading currents too slow. The errors for power factors of 80 were found to vary from 1 to 4 per cent. from the non-inductive load readings. On smaller power factors the errors were greater. Thus, for a power factor of 60 the error in one meter tested on full load was found to be as much as 12 per cent., while in others it varied from 5 to 15 per cent., and in one meter it was found to be over 20 per cent. The errors when leading currents were used were found to be a little greater with the same power factor and load than with lagging currents. The induction meters were not affected noticeably under power factors of 60 or more. With smaller power factors, however, they all ran more or less too fast, except one which was oppositely affected, it being made to run too slow.

All meters would run too slow if they were not kept clean and had their pivots and jewels in the best of condition. It was thus found that an old meter tested which ran much too slow was improved 5 per cent. by changing its jewel and pivot, and it was improved 3 per cent. more by polishing its commutator, and cleaning its integrating train, making it run nearly correct on full load and start on a much smaller load than before.

The effect of not having the meters installed level was quite marked on small loads. It was thus found that all meters tested would run from 3 to 8 per cent. too slow on loads of one-fifth of their rated capacity when inclined 10°.

Compensating the meters for friction makes them start and run on much smaller loads than when not compensated. The latter, however, were found to be very little affected by vibrations, while the former were considerably affected, some of them also being made to creep on no load.

Subjecting a meter to short circuits has the tendency to weaken the retarding magnets and make it run too fast. Thus one meter tested ran 3 per cent. faster, having blown two 10-ampere fuses in a fuse block having a distance of 1 inch between binding posts. All the direct current meters tested were more or less affected by short circuits. Those meters having their leading-in wires at the top were, however, much less affected than the meters which had their leading-in wires at the bottom. Induction meters having iron shields were not affected by short circuits. Large masses of iron placed near the meters made most of those without iron fields run too slow, but did not affect those having iron fields. Different temperatures, atmospheric pressures, humidity, etc., affected one type of ampere-hour meters considerably, but had no noticeable effect on any of the other meters tested.

Aging has considerable effect on most meters. Thus two meters were installed new from the factory in a place where there was some vibration. After three months' service they were found to run nearly 3 per cent. slower than when installed. Several other meters tested for aging

showed similar results. Thus a new 25-ampere, 220-volt, 3-wire meter ran before installation 7 per cent. too fast on 1-ampere, .9 per cent. too fast on 20-ampere, and 1.1 per cent. too fast on 30-ampere loads. After having been in service three months in a place free from vibrations it ran 15 per cent. too slow on 1-ampere, 1 per cent. too slow on 20-ampere, and 3 per cent. too slow on 30-ampere loads.

A 10-ampere, 100-volt, 2-wire compensated wattmeter tested before installation, ran coraectly on 3-ampere, 1.4 per cent. too fast on 3-ampere and 8 per cent. too fast on 8-ampere loads. After three months' service it would not run at all on 5-ampere loads; on 3 ampere it ran 2 per cent. too slow and on 8-ampere it ran 1 per cent. too slow.

Nearly all induction meters will start on smaller loads than meters with commutators. It was thus found that some of the induction meters tested would run fairly correct on less than 12-watt loads.

Several tests were made in order to compare the performance of meters with commutators on alternating and direct currents, and it was found that most of the meters tested would run with exactly the same accuracy on alternating as on direct currents.

Some Sub-Station Dangers and Their Prevention.

In discussing this subject the *Electrical Review* (London) remarks that though danger of life and limb to the electricians in charge of converting sub-stations is happily nowadays v ry slight, it is nevertheless not a negligible quantity, and a few points that may help to still further reduce the chance of accident may be deemed worthy of consideration.

In the first place there is the danger of the rotary sparking across at the brushes owing to any sudden surge in the high tension voltage. This, of course, cannot be prevented, and the only way is to keep a reasonable distance from the commutator while the machine is on load; in this respect, lubrication of the commutator with paraffine wax should not be encouraged, as it tends to help arcing, especially if there happens to be a hunt on at the time. In our own experience we have seen bad burns received in this way, the flash occurring while the attendant was examining the lubrication of the carbons, and striking him full in the face, taking off the skin and burning away the hair.

Then the terminals of the machine should certainly be covered with a wooden box at least (such a box can be made quite ornamental in a simple way). Usually the positive and negative terminals, consisting of flat rectangular blocks, lie quite close to each other, and it is the easiest thing in the world to lay a spanner or a file across them in an unthinking moment, or perhaps some such tool has been placed on a machine not running, and on starting up has lain unnoticed, with the consequence of a dead short and attendant evils.

While on the subject of the rotary itself, a few further practical points may be of interest.

In one case, in order to soften the brushes and insure continuous lubrication and silent running, resort was had to boiling them in castor oil for several hours. This plan was at first satisfactory, but the carbons soon began to give trouble by heating and burning away at their rubbing surfaces. The oil also became troublesome by oozing out, due to this heating, causing the carbons to stick to the brush holders, and when in course of time they had to be removed, the greatest difficulty was experienced in getting them out of their holders; the oil seemed to form into a hard, dry cement, which stuck tenaciously to the brass, the consequence being that it took several hours of hard chipping to get them shifted. This lubrification is, however, unnecessary, for by setting the brushes at the proper angle, and by careful attention to the regulation of pressure, they can be made to assume a glass-like surface, and require practically no attention at all. Another point is the use of an arrangement whereby the brushes on the slip rings can have their pressure varied by an easily get-at-able screw instead of having to undo nuts and bolts.

A danger that is always (or nearly always) neglected, is the bringing of brass knobs through the switchboard panels from the iron supports behind. These knobs are always in good connection with earth, and the danger lies in the fact that careless or accidental connection with the switches by a metal tool sometimes occurs, with the inevitable short, as the switches are less than a foot away. No doubt a very fine polish can be put upon these knobs, but in the interests of safety they should be capped with ebonite or other insulation. Such a cap, occasionally seen, is susceptible of a high polish, and, though of a dark color, does not affect the amenities. We have seen such a short as that described, with bad burning as the result. Another source of danger is the heating of the secondary switches through faulty connection with the joint-ing behind; a high resistance is set up, and in bad cases a very high temperature is developed.

The boosters need careful looking after, as it is rather hazardous to have the terminals of a machine alive that is not on load (the booster, rotary and induction motor are here assumed to be on one shaft). The remedy is, of course, the removal of booster plugs from the panels of all machines not on load; and while on this subject we may say that the method in vogue of screwing in the plugs is certainly rather clumsy and awkward, to say nothing of the wearing away of the thread due to the weight of the plugs while being inserted. The operation, too, is rather a long one. Surely a system of switches might be used with advantage.

Again, there is always the chance that the carbon on the breaker may fly out when the latter is suddenly released. This point needs careful looking after, as we have seen a carbon block thus fly and very nearly strike the operator. In dusting the panels, on the high tension side at any rate, one hand only should be used, despite the fact of the rubber matting beneath, while any unnecessary touching of voltmeters should be discouraged.

In lubricating the slip rings a longer stick might be employed than is generally in use, to insure safety from an unexpected earth.

In connection with outside work, in section pillars, etc., it is of importance that all inter-connectors should be tested before the switches are pulled out; for though such inter-connectors be assumed dead, nevertheless cases have occurred when they were alive through previous faulty manipulation. We have heard of a very bad burning accident occurring recently through the pulling of a live inter-connector understood to be dead. Again the springs in the switches seem in many cases to rot or oxidize away, with the consequence that such switches are practically useless in case of emergency.

A complete outfit of medical necessaries should be at hand in every sub-station, while the address of the nearest doctor should be plainly and legibly written above the medical cabinet.

Notes on What and How to Learn in an Electrical Engineering Works.

By Mr. G. Ralph, in *Elec. Engr.*

The following rough notes have been put together in the belief that they may be of assistance to apprentices going through the various departments of an electrical engineering works, by directing their attention to important points they should look out for in any department.

To become acquainted with any business, particularly in all branches of engineering, it is extremely important that an apprentice should learn the reason why things are done in a certain manner as well as learning how to actually do them. It may here be said that unless an apprentice shows a keen interest in the work which is going on in the department in which he is engaged, it is quite certain that the foreman will not interest himself in the apprentice, nor will he take the trouble to explain things. But if a proper interest be exhibited, everyone, from the manager and foreman downwards, will be found always ready and willing to impart information. Of course, a judicious time should be chosen in asking information from the foreman or men. It is not the right time to ask when one can see plainly that the party is engaged on something which is demanding his whole attention at the moment.

A most excellent little book dealing fully with what and how to learn in an engineering works was published by E. and F. Spon, entitled "Workshop Manipulation," by Richards. This book ought to be in the hands of every engineering apprentice, but, being out of print, can probably only be obtained now through a second-hand bookseller. The following are a few of the more important points which the apprentice should notice and think about in the various departments:

Machine Shop.—1. The importance of making out work on the marking table before machining operations are commenced.

2. The cutting speeds of various classes of tools, such as lathes, boring machines, planers, etc.: also the difference in speed for different materials operated upon.

3. The special tools used for boring bearing brasses, etc.

4. The importance of the use of gauges for accurate work and interchangeability.

5. Think out the reasons which probably determine whether a certain piece of work shall be done on a particular class of machine, when it is possible to do it in several different ways.

6. The angles of the cutting edges of tools.

The Foundry.—1. The way moulds and cores are ventilated.

2. The importance of making that part of the casting which must be perfectly sound and free from dirt the bottom side of the mould.

3. See at which point the metal is run to a casting, and why it is better at one particular place than another.

4. The various qualities of brass and gun metal best adapted for certain classes of castings.

5. The dressing of moulds to obtain a smooth, clean surface.

The Pattern Shop.—1. The amount of allowance for machining being left on various sizes and classes of castings.

2. The amount of taper to allow of patterns being easily withdrawn from the moulds.

3. The amount allowed for "shrinkage" or contraction for castings in various sorts of metals.

4. How core boxes must be made to take to pieces easily to remove the loam cores.

5. How cores are to be supported and located by "prints."

6. Think how the casting will probably be moulded, which side down, and where the joint in the mould will be; the reasons will then be seen for coring out certain parts, or leaving bosses or other parts loose on the pattern, so that they be drawn out of the mould after the body of the pattern has been removed.

The Fitting and Erecting Shop.—1. The marking off of bedplates for dynamos and motors.

2. The fitting of keys in armatures, couplings, etc.

3. The building of armature cores.

4. The saving of time which is effected when the various parts of a machine are made accurately enough to require very little fitting together.

The Brass Finishing and Instrument Shop.—1. The various classes of switchboards and arrangement of switches and connections upon them.

2. The construction of switches and various means adopted to secure good contact between the jaws.

3. The construction of commutators and the care necessary in insulating them.

4. The connections and terminals of dynamos and motors.

5. The construction of projectors and arc lamps.

6. Fittings adapted for use at various classes of installations, ships, collieries, mills, etc.

Capstan Lathe and Milling Shop.—1. The form and arrangement of tools in the turret.

2. The enormous saving of time in making quantities of small parts on these machine tools over making them by hand in the ordinary brass-finisher's lathe.

3. The variety of work which can be performed on a universal milling machine.

4. The importance of doing repetition work by milling instead of by hand filing or grinding.

5. The speed used in milling different materials.

Tool Shop.—1. The degree of hardness to which tools are tempered for various purposes.

2. Methods of hardening, the heating, cooling and tempering.

3. The angles to which tools are ground for turning planing and boring, etc.

4. Methods of grinding milling cutters, taps, reamers, etc.

5. Various forms of jigs and templates for repetition work on milling and drilling machines.

Steam Testing Shop.—1. The arrangement of steam pipes and reducing valves, drain pipes, etc.

2. The arrangement for lubrication on various makes of engines.

3. Various forms of governors, how they act and within what limits they will govern.

4. Indicating and working out the horse power of engines.

The Winding Shop.—1. The various classes of material used for insulation and the thickness of the same for various purposes.

2. The importance of leaving plenty of length of surface to prevent leakage to earth in armature cores and slots, commutators, etc.

3. The method of making drum armature bars, formed coils, etc.

4. The form of end "crossings" in drum armatures and how connected up.

5. How wires or conductors are insulated from each other to withstand high voltage.

6. Think out which are the weakest places in the various forms of armatures.

The Test Room.—1. The usual tests for dynamos, temperature, speed, compounding, or variation of pressure in shunt-wound machines.

2. The usual test for motors, also brake tests for efficiency.

3. The testing of two identical machines for efficiency by the "Hopkinson" method.

4. The various classes of instruments used in making the tests, and the principles upon which they work.

5. Methods of calibrating instruments.

6. Methods of regulating the speed of motors.

Installation Work.—1. The difference in arrangement of lights for various classes of buildings, etc., amount of light per square foot of ground area.

2. Various methods of running wires—in casing, iron pipes, steel conduits, lead covered, etc.—and the classes of work to which each is specially applicable.

3. Methods of jointing small wires, large cables, etc.

4. In motor work, notice the various forms of gearing employed for reducing speed and applying the motor to drive machinery.

5. The special classes of work best adapted for (1) series motors, (2) shunt motors, (3) compound motors.

6. The amount of power required for driving various classes of machinery.

7. Notice the engine and boiler plant at various works, the arrangement of steam pipes, pumps, feed-heating, etc.

The Drawing Office.—1. Pay particular attention to the importance of being able to make hand sketches, properly dimensioned, quickly, from existing machinery.

2. The importance of dimensioning drawings in such a way that the dimensions can be easily found. Look at the matter from the workman's point of view, and give all dimensions necessary for a man to complete the job without having to add up or subtract several dimensions.

3. When designing anything new endeavor to avoid unnecessarily small fractional parts of an inch. Make things to even dimensions, if possible, without resorting to $\frac{1}{16}$, $\frac{1}{32}$ and $\frac{1}{64}$.

4. There are generally several ways of making a thing. Aim at the most direct and simple from a manufacturing point of view.

In conclusion, part of the last chapter of Mr. Richard's book may very fitly be quoted:

"A mechanical engineer who has not been 'through the shops' can never expect to attain success, nor command the respect of even inferior workmen. Without a power of influencing and controlling others, he is neither fitted to direct construction, nor to manage details of any kind connected with engineering industry. * * * No one can expect to prepare successful designs for machinery who does not understand the details of the construction. * * *

"Some hints will now be given relating to apprentice experience in a workshop.

"Upon entering a shop, the first thing to be done is to gain the confidence and respect of the manager or foreman who has charge of the work. * * * To command the confidence of a foreman one must be punctual, diligent and intelligent. * * * The least word or act that will lead workmen to think that an apprentice is indifferent at once destroys interest in his success, and cuts off one of the main sources from which information may be derived.

"Punctuality costs nothing and buys a great deal; a learner who reaches the shop a quarter of an hour before starting time and spends that time in looking about manifests thereby an interest in the work, and avails himself of an important privilege—one of the most effectual in gaining shop knowledge. Ten minutes of his own time spent in walking about, noting the changes wrought in the work from day to day, furnishes constant material for thought and acquaints a learner with much which would otherwise escape his attention. It requires, however, no little care and discrimination to avoid a kind of resentment which workmen feel in having their work examined * * * where such inspection is thought to be prompted by curiosity only. The better plan in such cases is to ask permission to examine work from the person concerned, and such an application will generally secure both consent and explanation.

"Politeness is as indispensable to a learner in the works as to a gentleman in society. The character of the courtesy may be modified to suit the circumstances and the person, but still is courtesy. * * * Without the art of questioning but slow progress will be made in learning shop manipulation. * * * The main point is to consider questions before they are asked, make them relevant to the work in hand and not too many. * * * It is important in asking questions to consider the mood and present occupation of the person addressed. * * * One question asked when a man is in a communicative humor is worth a dozen questions when he is engaged and not disposed to talk.

It is a matter of courtesy in the usages of a shop, and one of expediency to the learner, to ask questions from those who are supposed to be best informed on the subject to which the questions relate. * * * There is not a more generous or kindly feeling in the world than that with which a skilled mechanic will share his knowledge with those who have gained his esteem, and who, he thinks, merit and desire the aid that he can give. * * *

"If asked for advice as to the most important object for an apprentice to aim at in the beginning of his course, nine out of ten experienced engineers will say, 'To do work well.' * * * Methodical exactness, reasoning and persistence are the powers which lead to proficiency in engineering pursuits. There is, perhaps, no more fitting conclusion to these suggestions for apprentices than a word about health and strength. * * * One not accustomed to manual labor will, after commencing, find his limbs aching and his hands sore. He will feel exhausted both at the beginning and at the end of the day's work. These are not dangerous symptoms. He has only to wait until his system is built up so as to sustain this new draught upon its resources, and until Nature furnishes a power of endurance, which will in the end be a source of pride and add a score of years to life. Have plenty of sleep, plenty of plain, substantial food, keep the skin clean and active, laugh at privations, and cultivate a spirit of self-sacrifice and pride in endurance that will court the hardest and longest efforts. An apprentice who has not the spirit and firmness to endure physical labor and adapt himself to the conditions of a workshop should select some pursuit of a nature less aggressive than mechanical engineering."

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, August 10th, 1903.

Cheap Information Dodge.—A New Departure in Carbonization.—Meter Rents.

The *Journal of Gas Lighting* for the current week contains some very pertinent remarks upon one or two abuses in business circles, and amongst others refers to the cheap information dodge, under which title is described the practice of sending out circular letters of inquiry with a stamped envelope for reply. This is very rightly characterized as an inglorious attempt to obtain, at the cost of a few penny stamps and a small amount of stationery, information or advice which should be paid for in the same way as a lawyer or doctor is paid. These circulars involve considerable trouble to the recipient and occasionally savor of impertinence. For example, amongst the few specimens that I have saved from the waste paper basket, not for the purpose of reply, I find one emanating from a gentleman whose only connection with the gas industry is a seat on the board of a small suburban concern, asking for information as to the best type of regenerator furnace, and offering to reciprocate when required in return. The value of this consideration, coming from a gentleman who scarcely knows the difference between a retort and a gasholder, can be readily assessed. The dozen of the collection comprises 32 questions and several range from 10 upwards, involving over one hour's hard work for an efficient answer; while some, as instanced by the example above given, amount to writing a chapter for a treatise on gas engineering. But assuming a good batch of answers to a technical question to be obtained, what value are they to any but a practical man? In many cases the object of obtaining them is simply for the purpose of opposing a professional adviser. A budget of replies would furnish good material to a competent engineer able to sift out from his own particular view and knowledge of local circumstances the wheat from the chaff. But in the hands of a non-technical man (and professional men do not, except under very exceptional circumstances, resort to the "inquiry dodge") they are simply valueless. The better plan for people who feel their lack of experience and information is to employ good professional advice and to act on such advice when they have obtained it. These are the lines on which the best results are obtained. Then some of these questions relate to prices of materials or certain kinds of labor, and are of a nature that might prudently be regarded as to some extent private, and more than one of my friends have reason to believe that some particulars, thoughtlessly entered on the inquiry form, have come back to roost in an unexpected and equally undesirable manner. By all means let us have our technical literature, but it cannot be too clearly understood that hurried reference to a file of periodicals does not constitute a qualified professional adviser, and that the man with a pocketful of replies cannot be evenly matched against a personally qualified competent opponent. Technical literature is all very well in its right place, the hands of the technical man, but it is as useless to the novice or outsider as the budget of replies obtained by means of the cheap information dodge.

I have lately been engaged in some experiments with a new method of carbonizing coal, which offers promise of a substantial improvement, both in yield of gas and of coke, upon ordinary working, and also the prospect of utilizing any and every kind of coal that is capable of yielding gas, including cheap small and slack of a kind that cannot be satisfactorily dealt with by ordinary methods. The process has been protected by patent granted to Messrs. Settle & Padfield, of Exeter, and the special feature is the use of vertical retorts, which are charged by means of a mechanical air-locking device with small quantities of coal, say 2 pounds to 7 pounds at a time. The effect of introducing the coal piecemeal, instead of dumping it in at one operation, is to introduce an entirely new set of carbonizing conditions. Instead of having a rapid production of high quality gas to begin with, gradually tailing off both in quantity and quality as the operation proceeds, giving such an inferior quality at the finish that with some kinds of coal it is the wisest policy to stop the distillation some little time before the gas is all driven off, and let the last few hundred cubic feet go to waste, there is a rapid and steady evolution of an even quality of gas. The results, put shortly, as compared with ordinary methods, are an increased yield of gas to the extent of 25 per cent. or more, and a slightly less increase in respect to actual sperm value. Over 6 cubic feet of gas per pound of coal can be obtained, and the coke is harder and increased to the extent of ½ cwt. to 1 cwt. per ton of coal, while tar becomes a negligible quantity altogether. If preferred, about half the usual quantity of tar can be obtained, or every bit of it can be converted into gas and coke. The experiments have extended to many different kinds of coal and exceed 100 in number. They have been conducted with one retort only so far, capable of dealing with 2 to 3 cwts. of coke per charge, but it is intended to work on a larger scale as soon as the plant can be put down, so as to get a fair test of actual working costs, capital expenditure, and so on. As an example of the somewhat hackneyed observation that history repeats itself, attention may be directed to the fact that the vertical retort, one of the first forms of retort used by Murdoch, is again coming to the front. Other inventors besides Messrs. Settle & Padfield appear to have had their attention directed to the advantages afforded by this form of retort. The idea of letting the coal tumble in at the top, and the coke tumble out at the bottom, a simple and cheap process in each case, has always proved attractive in theory. But no one has yet put it into satisfactory operation on a large scale and in a manner that gives a satisfactory yield of gas and also of coke. The best results as regards gas, with the Settle-Padfield process, are obtained by feeding on very small quantities, say 2-pound charges or so, but the coke is so bulky, light and friable as to be worthless as a commercial article. Where coal and consequently coke is cheap this might prove to be the better way of working, as a yield of 7 to 8 cubic feet of gas per pound of coal is obtained, but in most cases a good yield of hard coke is also required. To obtain this, larger charges, say 4 pounds to 7 pounds, must be used, and the results above recorded were obtained under such conditions. With a slightly reduced yield of gas—but still 25 per cent. more than is usually obtained—there is also a large yield of hard coke suitable, so far as physical qualities are concerned, for foundry or cupola use, or for water gas generators. And the process might be used in conjunction with water gas, the Settle-Padfield retort being fixed on the charging floor at such a level as to admit of the generators being charged with hot coke. This new method of working opens up a lot of possibilities and there is undoubtedly a future before it. The exact lines on which it will be worked, however, will require development by experience on a large scale. Amongst other investigations, exhaustive tests are to be made as regards the questions of calorific value and of naphthaline.

Who should pay for the cost of the meter? is a debatable question that has been settled in 9 cases out of 10 by charging the consumer a small rental sufficient to cover the bare cost. If the company charge a high rental sufficient to yield a handsome profit, then the consumer claims the right to provide his own meter or private firms step in and supply meters at a slightly lower rate. And if the meter is supplied gratis, or more accurately speaking, at the general instead of at the individual cost, then the question is sure to come up about what is to be done with the intermittent consumer who for one reason or another simply makes a convenience of the company. He may be a wealthy do-nothing, frittering away most of his time in foreign lands and returning at short and uncertain intervals to the old rooftree where he expects the gas company or rather the rest of the gas consumers to keep a meter waiting his pleasure in good order and repair. He may be a business man only using the premises during hours of daylight and

not requiring the meter for an hour a year, but still likely to require to go to the premises after dark. Or he may prefer to use less reliable agents for lighting and to have the meter as a standby. This has been the difficulty in the city of Edinburgh where the gas and electricity supply both belong to the corporation, and many consumers appear to have both laid on and to use which they think fit. It is the rule in that city to supply gas meters free of cost, and the question has come up about what is to be done with people who have a large meter and use no gas. It has been decided that under such circumstances a rent should be charged. It has been shown over and over again that the fairer way of charging is for each customer to bear the cost of every thing special to his service, because the cost is the same whether he uses gas daily or once a year. We are familiar with the old argument about the tradesman not charging for the use of scaling weights, but those who advance it overlook the fact that to get a fair comparison we must suppose that the tradesman has to supply a separate set of these appliances for the special and particular use of each and every customer who chooses to apply for them, and that irrespective of the quantity of business done. There is no comparison between two or three sets of scales and weights worth perhaps £5 on a tradesman's counter, and 2,000 or 3,000 meters fixed at each customer's house as required and costing £5,000 to £10,000. If a private individual was called upon to do business on such terms he would soon bargain for a minimum charge, and say that he could not do business at a loss by supplying appliances to people who did not use sufficient to cover the cost of service to say nothing about profit. It should be clearly understood that the intermittent or stand-by customer is a drag on the wheel of any undertaking and that he should at least pay his footing. And yet people are found who are so illogical as to argue that if they do not use the meter they ought not to be expected to pay for it. If they have a meter and service laid for their convenience they certainly ought to pay every penny both of cost and upkeep, and that irrespective of the quantity of gas used. The mere fact of ordering such is presumptive evidence of an intention to use it, and if such intention is not carried out there is good ground for claiming a full reimbursement of cost of service and possibly damages in addition. Ten per cent. of such intermittent customers would have the effect of appreciably keeping up the cost of gas to the other 90, for it may be assumed that the shareholders would not expect less dividend on their account. And there can be no two opinions as to whether the 90 per cent. should bear costs incurred for the inconvenience of the other 10. So it is really a question not of whether the gas company should provide the meters, but of whether the customer should pay for it himself or be provided at the expense of his neighbors. Whether a user of £100 worth of gas per annum should pay 100 times as much for his meter and service as a user of £1 worth. The only fair conclusion is that each should pay the same and this condition can only be secured by an equitable system of meter rents.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. E. B. SEYMOUR has resigned the position of Manager to the Corning (N. Y.) Gas and Electric Company.

REPLYING to many complaints of poor service, Mr. John H. Carruthers, General Manager of the Newton (N. J.) Gas and Electric Company, asks that the residents wait in patience until November 1st, when the betterments now being made on the plant will be completed. Meanwhile we suggest to Mr. Carruthers that it would be a good thing for the Company and the residents if the former were to secure a man competent to manage the gas end of its business.

THE Cincinnati *Times-Star*, of recent date, says that the consumption of gas tn that city is increasing on a wonderful scale. During June and July the Cincinnati Gas and Electric Company added over 2,000 new customers to its list. Over 2,000 new connections were made, the majority of these connections representing gas stoves. The July statement of the Company is one of the best on record, the figures being beyond the expectations of the most sanguine insiders. The net earnings increased nearly $20,000 for the month as compared with the returns of last year. A Director of the Company recently said: "We are doing a great business. The increase in the gas consumption in this city is simply remarkable, and what's more, there is every indication of a still greater increase in the future. The current year will be the greatest in the history of gas plant operations in this city up to this time."

A CORRESPONDENT in Los Angeles, Cal., forwards the following under date of the 20th inst.: "City Attorney Matthews has been directed by the Los Angeles City Council to apply to the Attorney General of the State for leave to bring suit against the Indianapolis Gas Company for tearing up the city's streets. This resolution was the outcome of an application by Bruce Cornwall for a privilege to lay gas mains without being in possession of a franchise granting him that right. The members of the Council in discussing the action of the Independent Company in laying gas mains without a franchise admitted that it had the right to lay mains for gas to be used for illuminating purposes, but insisted that the Independent Company was preparing to supply heat and power with its gas as well as light. This the Councilmen insist is illegal and they want the matter tested in the Supreme Court. This resolution was the product of a secret conclave at which only a part of the Councilmen were present. Councilman Todd offered the resolution, which was practically the same as the one directed against the Lowe Company last summer, with the exception that the right of the Company to lay mains for illuminating gas was conceded. After recounting with half a score of 'whereases' the particulars of the turning down of Bruce Cornwall's two applications, the resolution recites that,

Whereas, This Council has been subjected to much adverse criticism on account of its action in refusing such franchises to Mr. Cornwall, and also for its action in passing ordinances which have for their object the preventing of other persons and corporations from laying pipes in the streets for the purpose of supplying gas for purposes other than illumination until such person or corporation has obtained such franchise by purchase;

"'Now, therefore, for the purpose of determining the rights and powers of the city in such matters and for the purpose of settling the question as to whether or not persons or corporations have the right under the constitution to tear up the public streets and lay pipes therein for the supplying or furnishing gas for purposes other than light without first having obtained a franchise from the city, it is hereby moved that the City Attorney be authorized and directed to bring action to settle and determine said questions and also to settle and determine the question as to whether a person or corporation not having a franchise from the city may sell and supply gas for any purpose, and if it be necessary therefor, he is hereby instructed in behalf of the city to apply to the Attorney-General for leave to bring an action in the name of the people against that particular corporation which is now engaged in laying pipes in the public streets for the supplying of gas without having a franchise from the city, and variously known as the Independent Gas Company, the Valley Gas and Fuel Company, the Suburban Gas Company, and against such Company under whatever name it may be tearing up the streets and laying pipe therein at the time said action is brought.'"

THE Producer Gas Apparatus Company has been chartered. Its principal place of business, or office headquarters, is in 1 Exchange place, Jersey City, N. J. It is capitalized in $25,000, and its incorporators are: Frank C. Tryon, Wallace Peck, Edward L. Clark, John H. Stringham and Philip Farnsworth.

THE Hanford (Cal.) Gas and Power Company, which has only been in operation a short time, reports the hooking up of 170 meters, and applications for 30 or more services are in hand.

THE proprietors of the Tacoma (Wash.) Gas and Electric Light Company have ordered a reduction amounting to 10 per cent. in the selling rates, the same to go into effect the 1st prox. The correspondent who sends us that information further says: "A year ago a reduction was made, coupled with the announcement that as the consumption of gas in Tacoma increased, further reductions would be made. Putting into effect this line of policy has culminated in getting the city new rates September 1st of this year. Tacoma is keeping pace, in a measure, with other modern cities in the matter of using gas. Though not yet in any sense equal to Portland and Seattle, the annual consumption shows decisive progress, and an entirely new conception of the simple, everyday uses that gas can be put to. Not many years ago, it took a rich man to even think of gas; it was a luxury. To-day it goes into homes like flour. It has been harnessed to work in so many different places, that keeping house without it is something like trying to run a home without water. According to the new plans of the Gas Company, the lighting rate will be reduced down to the present fuel rate, and all gas will be supplied through one meter. This will mean a gross rate of $1.60, with a discount of 5 per cent. if bills are paid on or before the 10th of the month, thus making the net rate $1.50 per 1,000.

It will enable homes to enjoy lights, gas heaters, cookers, broilers and all appliances on one and the same meter and at the same rate. Under this new rate arrangement, together with free services, it will not be long until houses without gas pipes will be considered just as incomplete as they would if they were without water pipes. It's this general utility of gas that makes it such a popular force. Some want it because it means Welsbachs, others for a reading light; then there's the army of housekeepers who lean on gas for cooking. One woman said: 'I'd have gas in my house if I didn't do a solitary thing with it but get the toast in the morning.' Others are just as enthusiastic because it means heat-in-a-minute in the bathroom. In this way, the use of gas keeps spreading, and as the price is established by the consumption, it is the intention of the local Company to make further reductions as the sales increase."

THE capital stock of the Youngstown (O) Consolidated Gas and Electric Company has been increased from $955,000 to $1,055,000. The increase is to be devoted to the making of important plant betterments.

THE latest gas incorporation on Long Island is known as the New York and Nassau Gas Company, and those most prominent in its make up are John B. Summerfield, of Arverne, L. I., Eben Jackson, of New York, and S. K. Fuller, of Brooklyn.

"A. L. F." forwards the following from Bridgeport, Conn., under date of the 22d inst.: "Mr. Frank B. Sammis, for 14 years Secretary and Treasurer of the Bridgeport Gas Light Company, has resigned his position, upon advice of his physician, and will go with his family to Southern California to live. Mr. Sammis tendered his resignation at a meeting of the Directors of the Company held some days ago, and it was reluctantly accepted. Geo. W. Roberts, Chief Clerk of the concern, was elected to succeed him. The resignation will take effect upon September 1. Mr. Sammis was for many years station agent for the New York, New Haven and Hartford railroad in this city. In 1889 he accepted the position of Secretary and Treasurer of the Bridgeport Gas Light Company, succeeding Gen. L. N. Van Keuren, who entered the firm of T. L. Watson & Co. Mr. Sammis has since held this responsible position, the duties of which he has executed faultlessly and with rare ability. His work, however, has gradually undermined his health, and he has been obliged to resign in order to obtain a change of climate and a rest. Mr. Sammis with his family will leave for Southern California about the middle of next month. He expects to reside in the vicinity of St. Bernardino, where he will make his permanent home if the place is suitable. The resignation of Mr. Sammis and the necessity which compels him to remove with his family to California are matters of deep regret to all who are acquainted with him."

AT a recent meeting of the City Council of Louisiana, Mo., an ordinance was passed granting a 20-year franchise to the Louisiana Gas and Electric Company. By the terms of the new franchise all former franchises are repealed, doing away with a number of objectionable features. The price of arc street lights of 2,000-candle power remains unchanged, being $80 per year, additional lights to be furnished at $60 per year. Incandescent lights the maximum charge to be 10 cents per 1,000 watts, and gas for light and fuel purposes $1.25 per 1,000 feet. The old franchise had over six years to run, but the plant had recently changed hands and the new Company changed its name and is endeavoring to overcome the bad record made by the old Company. Over $16,000 have been spent in improvements during the past few months.

ELKTON, So. DAK., is anxious to have a gas plant. The place looks too small to comfortably support such an enterprise.

THE following is from a recent issue of the Minneapolis (Minn.) *Journal:* "From figures prepared by Gas Inspector W. H. Roberts for the Commercial Club, it will cost less than $50,000 extra to have the city streets lighted as they are in modern and progressive cities. This is based on the prevailing prices of gas and electric light, but as there is no occasion for increasing prices the figures may be accepted as a fair guide on the difference between the cost of lighting according to the village or 'moonlight' system and the all-night system. The streets of Minneapolis are lighted by 967 electric arc lights, 5,400 gas lamps and 2,100 gasoline lamps. The gas lamps include those on Hennepin and Lyndale avenues, which have heretofore been maintained by the Park Board, but which have recently been abandoned by that body. The Council must take over the two streets. The electric lights cost the city $82 per year, but there are 212 electrics in the downtown districts which remain lighted all night and every night and cost the city $108 each per year. To light the remaining electrics according to the all-night schedule will entail an additional expense of but $6,900. The gas lamps come somewhat higher. While gas, according to the present rates, will cost the city $67,500 next year, by the village schedule, they will cost $36,400 more if kept going all night and every night. The gasoline lamps, over 2,000 in number, can be lit according to city style at for about $5,000 more than by the present system. In other words, while it will cost the city about $183,000 the next year to illuminate the streets by an antiquated schedule it will cost but $231,000 to adopt the St. Paul plan, which is admittedly one of the best lighted cities in the country. A great deal will be said about adequate street lighting before the board of tax levy at its important meetings by members of the Commercial Club and the Aldermen."

Machine Shop Methods.[1]

There is material for profitable study by the managers of small machine shops in the progress which has been made during recent years in the development of machine shop methods. This progress has been realized from a study in two directions: First, to decrease the labor cost of the product, without regard to the plant involved, and second, to increase the producing capacity of a given plant, without regard to the labor cost involved. The two purposes have proved to be convergent, in general. The results of the two lines of endeavor have value for both the small and the large producer. But since the machine building industry, like any other, rests on the work of the small producer, those achievements which operate for the profit of the small shop are of prime importance. It requires time, of course, for new methods to gain introduction and acceptance everywhere; first the knowledge and appreciation of their value must be spread through the ranks of shopmen, down to the smallest shops, and then a further time is required to overcome the inertia of existing machinery and equipment.

But the total period of introduction may be much shortened, with advantage to the machine industry as a whole, if every shop manager studies new methods and advanced ideas as they prove their worth, and considers how he may apply them to his work to increase his profits.

Even now there are many new methods and appliances which promise economies for many shops and factories that have as yet not considered their use. Pneumatic tools can be made a source of profit almost everywhere; only in the small minority of shops does the cost of the additional plant required equal the saving in labor for chipping, drilling, reaming or hammering.

High speed tool steel can be used in every shop to reduce the cost of roughing cuts. Very few machine tools are now worked up to their limit of strength, or operate in service so heavy that they would not stand the increased demand on their strength and power which is involved in the economical use of the new steel. The milling machine and the emery grinder have already won fairly wide adoption. To a lesser extent this is true also of standard gauges and limit gauges; the old notion that gauge working is necessary or economical only in "interchangeable" production has been quite thoroughly done away with. Trackway or trolley hoist systems have been shown by experience to be time and money savers in small and moderate sized shops as well as in more extensive establishments.

Driving machine tools by electric motors, individually or in groups, has been so well developed that very many new shops are designed for it from the first, and its adoption in a large number of existing works, scrapping the existing transmission plant, may be taken as proof of its value in cutting down coal bills (and sometimes labor cost, by giving readier speed change and better control generally). For existing shops of small size, of course, the extra capital outlay will in most cases prohibit the adoption of electric motor driving. Then there are other methods, such as the use of machine tools which are brought up to the work, that are suited only for large work or work of a special class; but because these methods do not apply to the small shop their general importance is less. The same is true to a large extent of advanced methods and principles in shop management and administration which have given gratifying results in large establishments. But leaving these out of account, there are abundant opportunities, as we have tried to suggest, for the small shop to make use of the experience gained in larger works, and by a progressive attitude to improve its profit balance.

1. *Engineering News.*

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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ELBERT P. CALLENDER,
EDITORS.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, AUGUST 31, 1903.

The Market for Gas Securities.

The net result in the stock shifting valuation process for the week leaves Consolidated in about the position that it held last week. There was less trading in it than has been reported for the past month or more, and it is likely that transfers will be fewer and quotations higher for it until the option to purchase the new stock has been exercised next month. The Company's business continues to grow in rather phenomenal fashion, and about everything it has in the generating line will be in active duty before November 15th. Local gas bonds are in some demand. The quotation for Mutual is well below its real value. In fact, so far as we can learn, no actual transfers have been made in Mutual for 6 weeks or more.

Brooklyn Union is nominally 185 to 200, but actual trading in it is dead. The business of the Brooklyn Company, like that of its big neighbor, increases wonderfully. In fact well informed people do not hesitate to say that its earnings are rather over than under 20 per cent. Of course, this reality exists. If the Brooklyn Union is to continue in separate ownership the Company must have a new works soon, which means an expenditure of millions. However, the Company has the cash.

Baltimore Consolidated is at 65 to 65¼, and Peoples, of Chicago, is steady at 95. The general list shows no particular change.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

AUGUST 31.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	178	178½
Central Union, Bonds, 5's	3,000,000	1,000	105	108
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	280	285
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	102	106
Northern Union, Bonds, 5's	1,250,000	1,000	105	106½
New York and East River Bonds 1st 5's	3,500,000	1,000	102	106
" 1st Con. 5's	1,500,000		109	111
Standard	5,000,000	100	135	140
Preferred	5,000,000	100	155	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	185	200
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅛	¼
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	5
" " Bonds, 5's	5,254,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central, San Francisco	1,900,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,550,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	95	95¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	5,025,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	65	65¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	87	95
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	77	79
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	..	65
" Bonds, 6's	2,650,000	..	104½	106
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	79	90
Preferred	2,500,000	100	85½	..
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000		105	105¾
New Haven	1,000,000	25	300	325
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	94¾	95
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	0,000,000	100	51½	52
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	95	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047.000	1,000	98½	99½
Washington, D. C	2,600,000	20	290	295
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del	600,000	50	232	..

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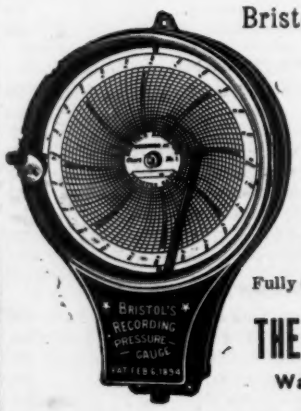

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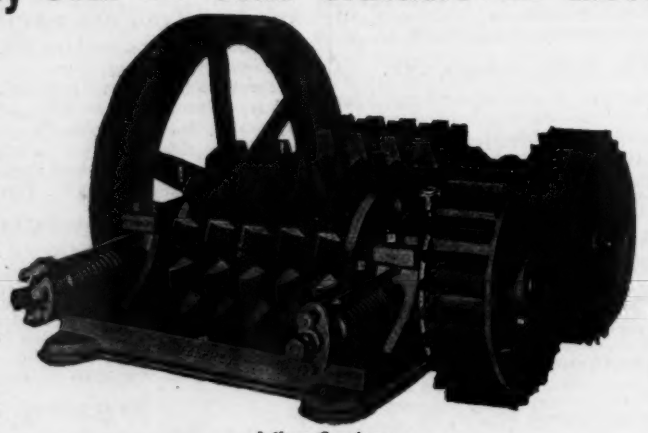

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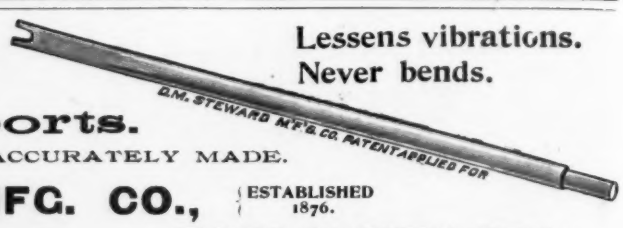

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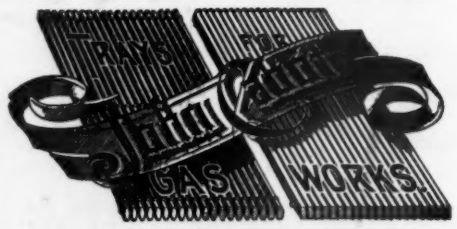

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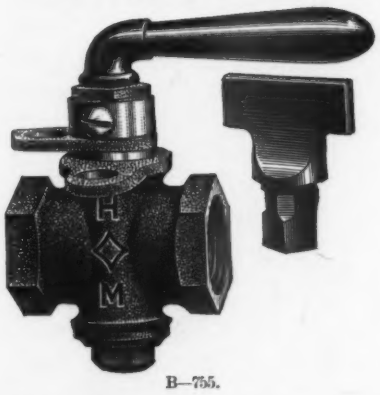

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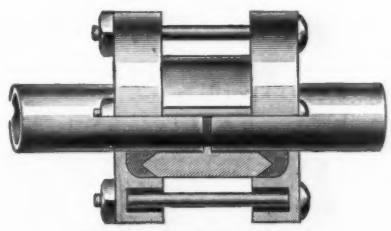

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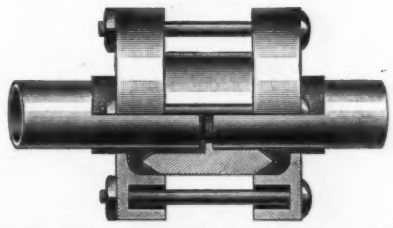

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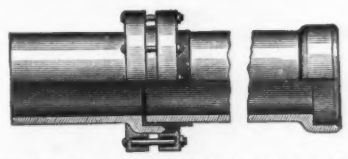

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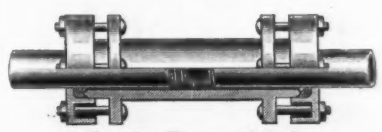

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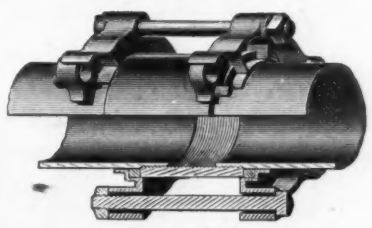

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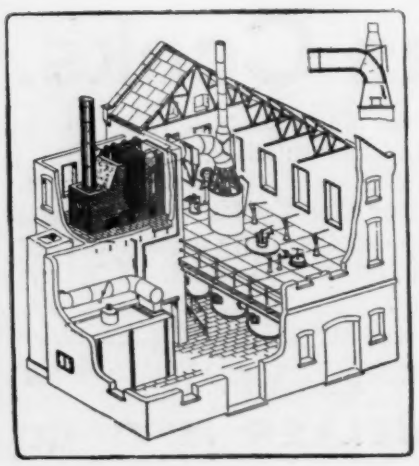

To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

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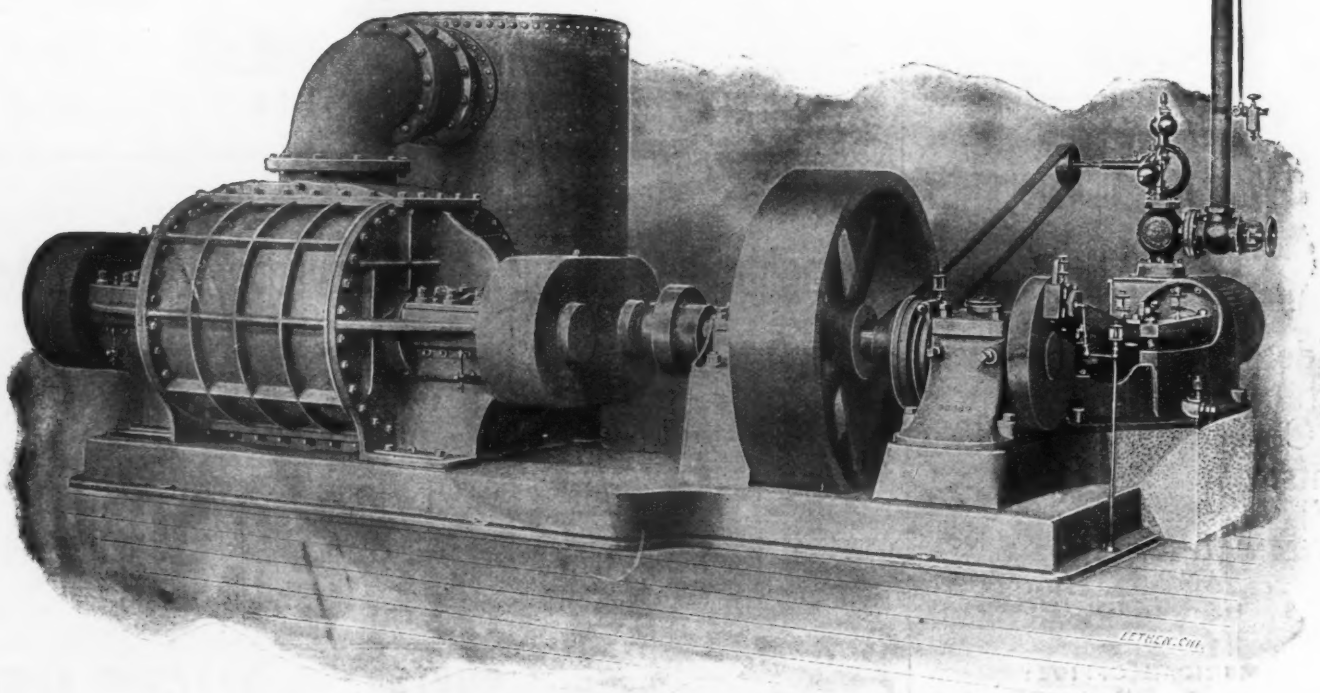

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WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

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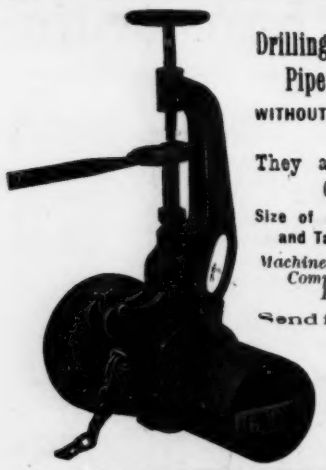

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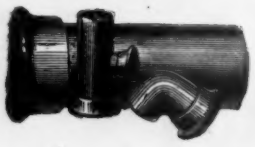

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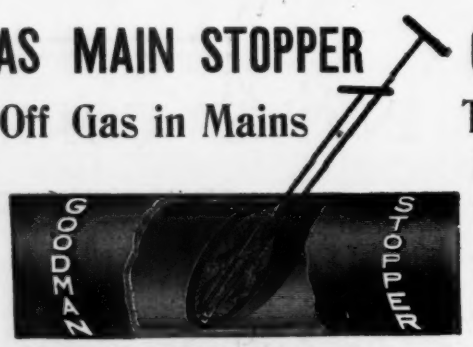

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Humphrey Crescent Instantaneous Water Heater

IS A QUICK SELLER.

PRICE,

$20.00.

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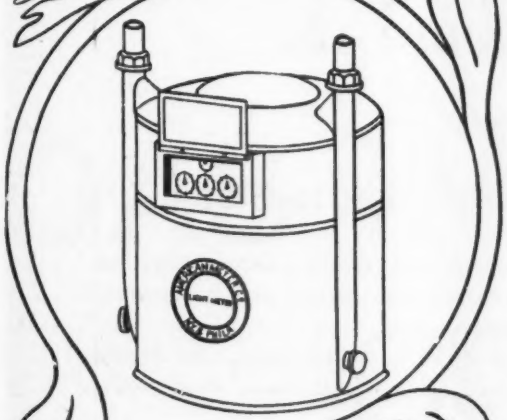
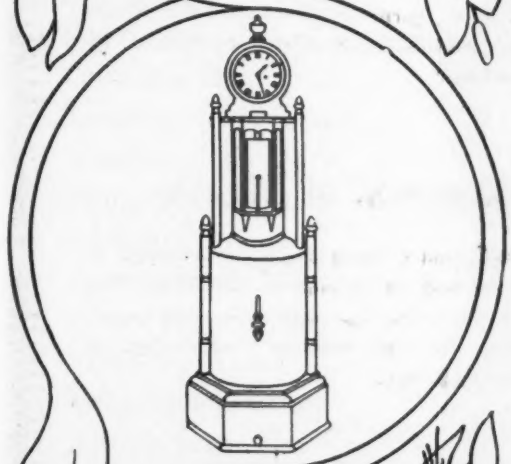
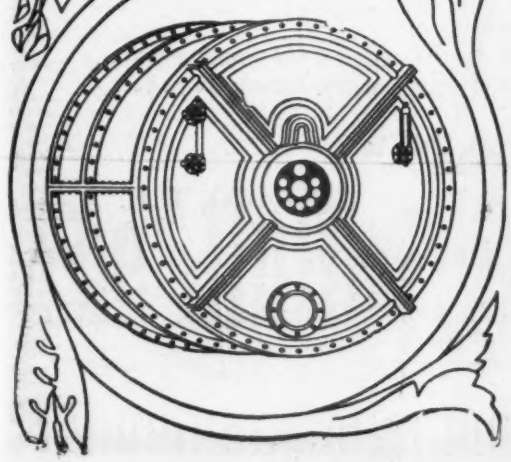


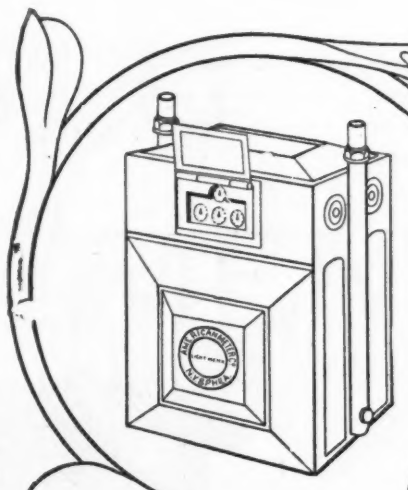


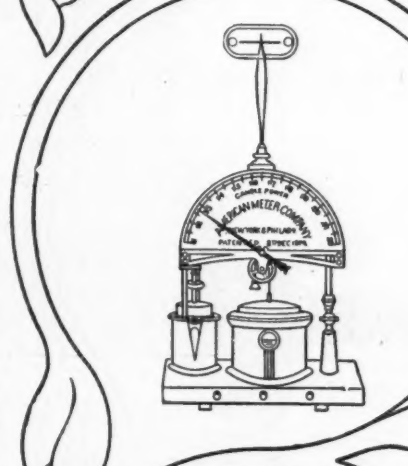


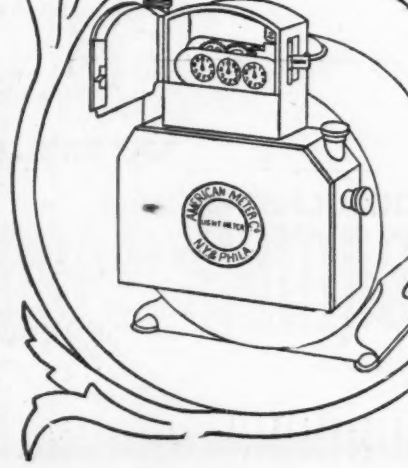
PUBLIC LIGHTING TABLE.

SEPTEMBER, 1903.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	12.30 AM	4.30 AM	6.30	4.20
Wed.	2	1.20	4.30	6.30	4.20
Thu.	3	2.10	4.30	6.15	4.30
Fri.	4	3.10	4.30	6.15	4.30
Sat.	5	No L.	No L.	6.15	4.30
Sun.	6	No L. FM	No L.	6.15	4 30
Mon.	7	No L.	No L.	6.15	4.30
Tue.	8	6.50 PM	8.10 PM	6.15	4.30
Wed.	9	6 50	8.40	6.15	4.30
Thu.	10	6.50	9.20	6.05	4.40
Fri.	11	6.50	10.00	6.05	4.40
Sat.	12	6.50	10.40	6.05	4.40
Sun.	13	6.40	11.30	6.05	4.40
Mon.	14	6.40 LQ	12.20 AM	6.05	4.40
Tue.	15	6.40	1.20	6.05	4.40
Wed.	16	6.40	2.30	6.05	4.40
Thu.	17	6.40	4.40	5.55	4.50
Fri.	18	6.40	4.40	5.55	4.50
Sat.	19	6.40	4.40	5.55	4.50
Sun.	20	6.30 NM	4.50	5.55	4 50
Mon.	21	6.30	4.50	5.55	4.50
Tue.	22	6.30	4.50	5.55	4.50
Wed.	23	6.30	4.50	5.55	4.50
Thu.	24	6.30	4.50	5.40	5.00
Fri.	25	8.00	4.50	5.40	5.00
Sat.	26	8.40	4.50	5.40	5.00
Sun.	27	9.30	4.50	5.40	5.00
Mon.	28	10.20 FQ	4.50	5.40	5.00
Tue.	29	11.10	4.50	5.40	5.00
Wed.	30	12.10 AM	4.50	5.40	5.00







TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45

No. 904 Welsbach Outdoor Arc

Furnished with 2, 3, 4 or 5 Burners

This Lamp is Built to Stand

rough usage and severe weather conditions. In mechanical construction and workmanship it is perfect.

The material is of the best. All exposed metal parts made of cold rolled sheet copper.

Guaranteed Positively

Rain-proof

Wind-proof

Insect-proof

The main cock lights one or all burners. Pilot flash light.

18-inch enameled steel reflector shade.

Long tube burners, with adjustable needle gas feed, permit use of either 3½-inch or 4½-inch mantles.

Renewal of Mantle

made easy and without danger of breakage by raising the body of the lamp on main stem. The neck of the globe thus acts as a wind guard, protecting the other mantles from damage by weather conditions.

Candle Power Test

of 4-burner lamp:

With 3½-inch mantles, 412-candle power.

With 4½-inch mantles, 503-candle power.

WELSBACH COMPANY,

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ORDERS ACCEPTED FOR SHIPMENT ON AND AFTER SEPTEMBER 15.

Sample Case of 3, 6 or 12 lamps sent on 30 days' approval at prices based on 100 lamps.

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For the Six Months Ending July 1, 1903, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus

Rochester, N. Y.	Brooklyn, N. Y.	Waltham, Mass.
Baltimore, Md.	Hempstead, N. Y.	Dover, Del.
Chicago, Ills.	Chester, Pa.	Allentown, Pa.
Amesbury, Mass.	Lynn, Mass.	Savannah, Ga.
Aberdeen, S. D.	Newark, N. J.	New York (Central Union Co.)
Winsted, Conn.	Washington, D. C.	Cicero, Ills.
Canon City, Col.	Boone, Ia.	Chicago (Ogden Co.)
Schenectady, N. Y.	Pueblo, Col.	Easton, Pa.
Hagerstown, Md.	Charlotte, N. C.	Lawrence, Mass.
Malden, Mass.	Fall River, Mass.	Council Bluffs, Ia.
Bridgeport, Conn.	Duluth, Minn.	Chattanooga, Tenn.
Albert Lea, Minn.	New York (Mutual Co.)	

TOTAL SETS TO JULY 1, 1903, ... 51
TOTAL DAILY CAPACITY, ... 55,150,000 cubic feet.
TOTAL SETS TO DATE, ... 498
TOTAL DAILY CAPACITY, ... 354,830,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia

Established 1858. Incorporated 1890.
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Construction Vertical 8's (Patented). First Instalment in the World with Modern Charging and Discharging Machinery.

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BENCH SETTINGS,
Fire Brick, Tiles, Etc.

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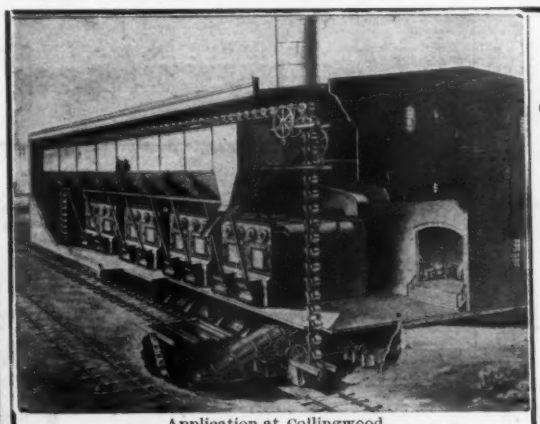

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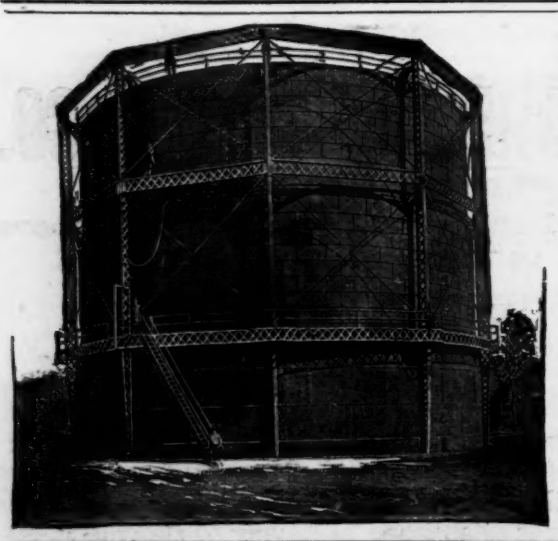

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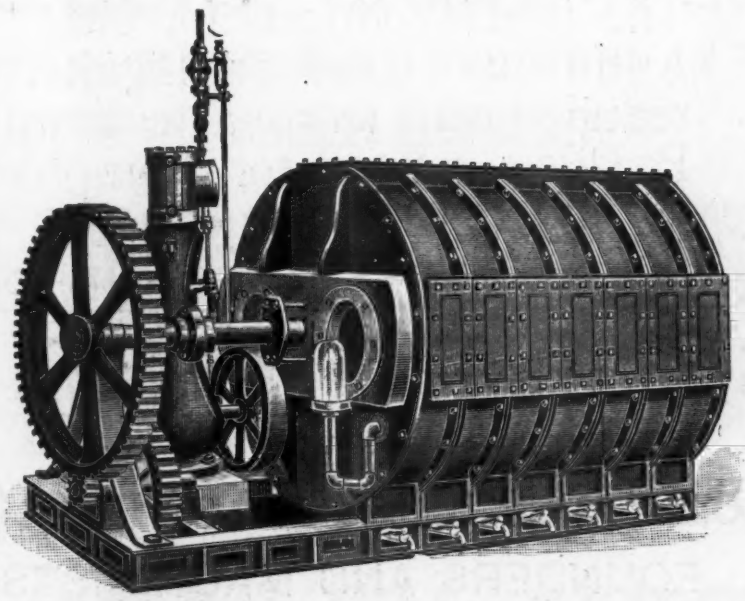

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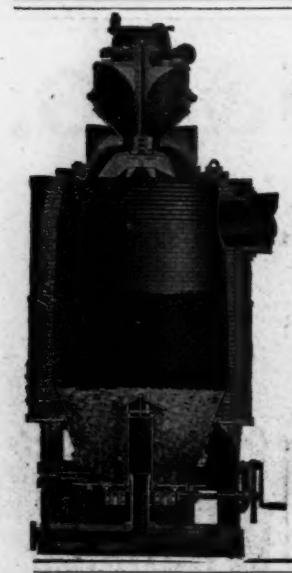

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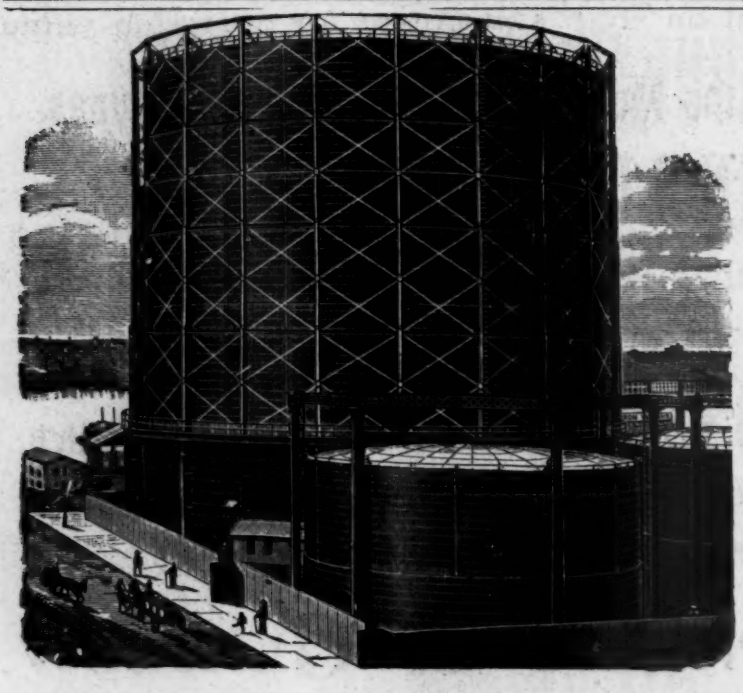

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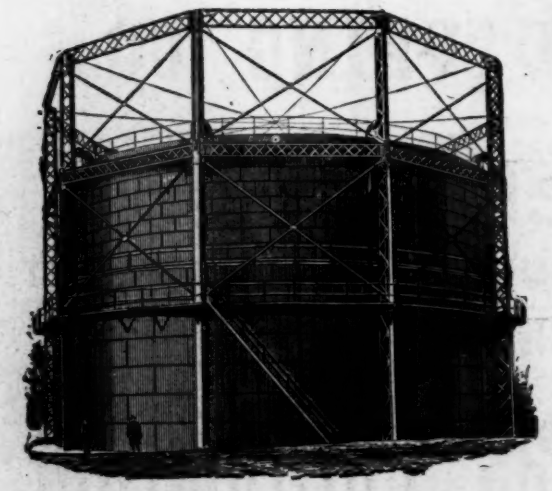

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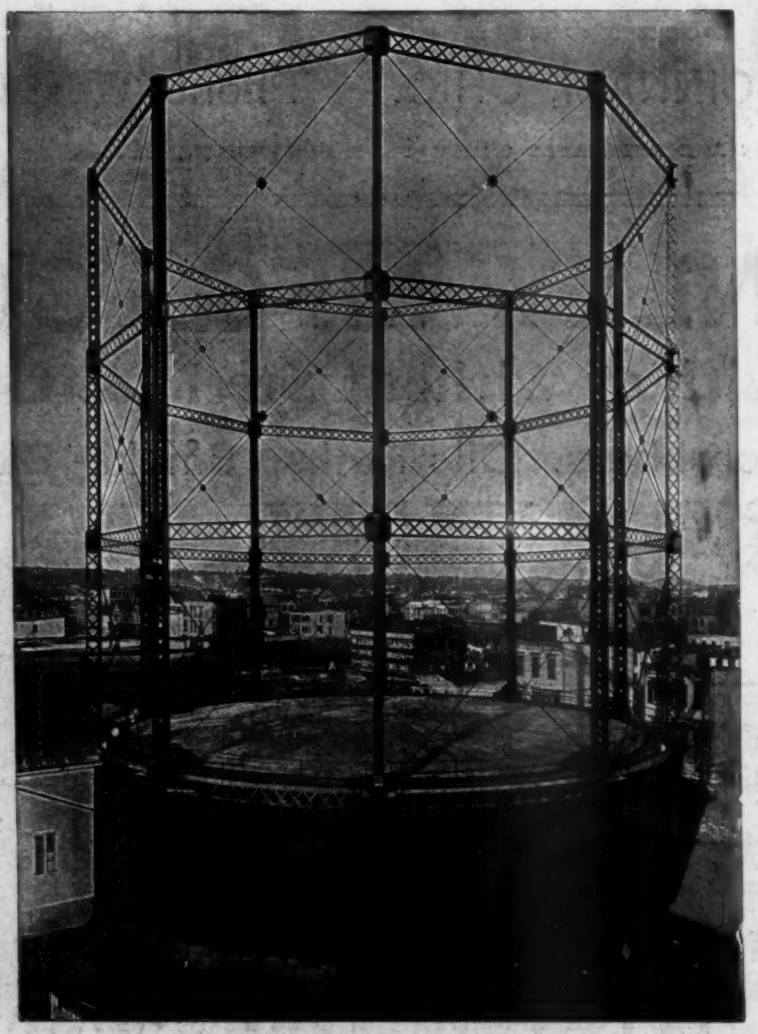

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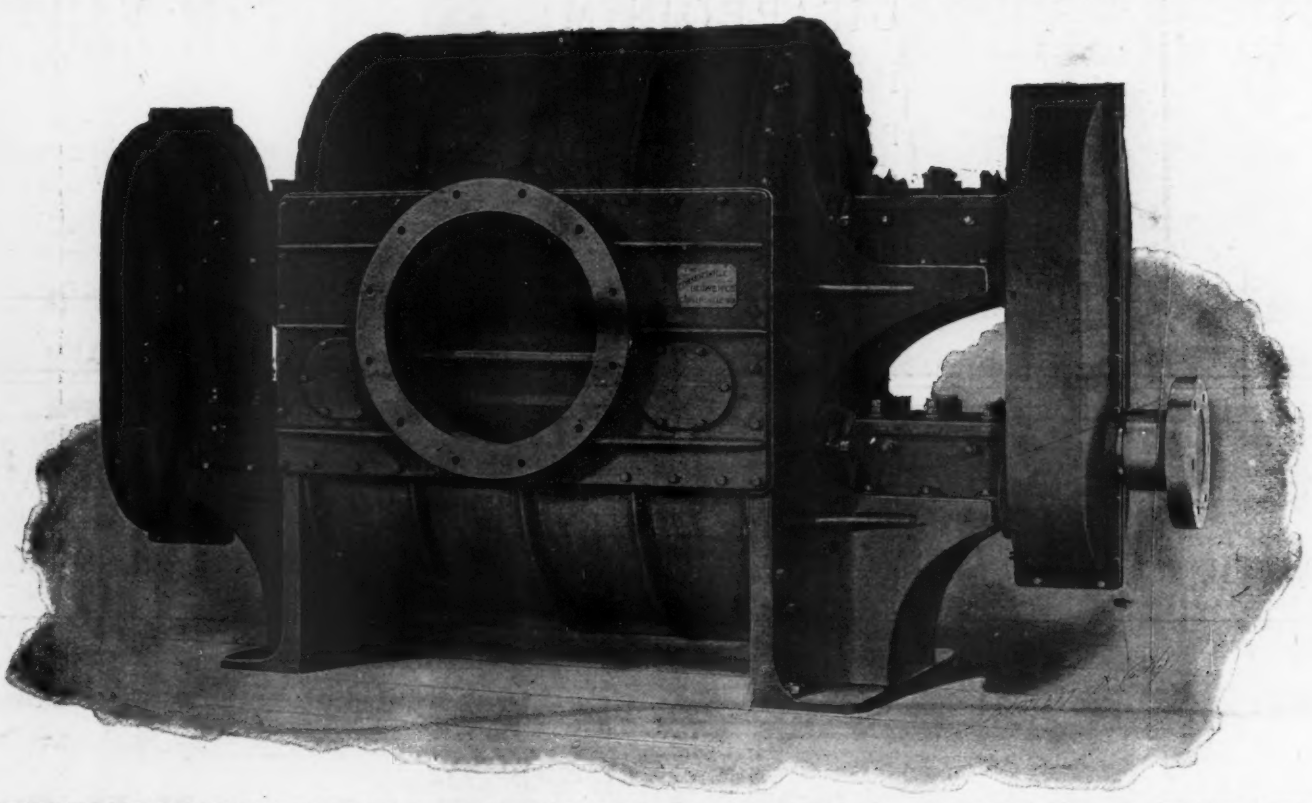

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